This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

JAN 2 1925

B 434790

TRANSACTIONS

OF THE

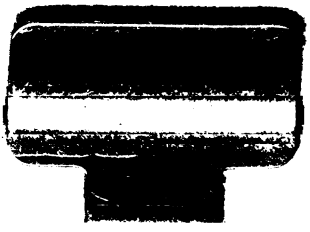
Massachusetts Horticultural Society.

FOR THE YEAR 1891.

PART I.

BOSTON:
PRINTED FOR THE SOCIETY.
1891.

☞ SEE LAST PAGE OF COVER.



TRANSACTIONS

OF THE

Massachusetts Horticultural Society,

FOR THE YEAR 1891.

PART I.

MASSAC

BOSTON:
PRINTED FOR THE SOCIETY.
1891.

FROM THE

:TTS HORTICULTURAL SOCIETY.

Please acknowledge receipt to

ROBERT MANNING, *Secretary.*

N. Y. State Lib.
12-29-1925

The following papers and discussions have been circulated to some extent in the form of slips reprinted from the reports made by the Secretary of the Society in the Boston Transcript. As here presented, the papers are printed in full, and the discussions are not only much fuller than in the weekly reports, but, where it appeared necessary, have been carefully revised by the speakers.

The Committee on Publication and Discussion take this opportunity to repeat what they have before stated, that the Society is not to be held responsible for the certainty of the statements, the correctness of the opinions, or the accuracy of the nomemclature in the papers and discussions now or heretofore published, all of which must rest on the credit or judgment of the respective writers or speakers, the Society undertaking only to present these papers and discussions, or the substance of them, correctly.

O. B. HADWEN,
WILLIAM H. HUNT,
FRANCIS H. APPLETON,
Committee on Publication and Discussion.

TRANSACTIONS

OF THE

Massachusetts Horticultural Society.

BUSINESS MEETING.

SATURDAY, January 3, 1891.

A duly notified stated meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

This being the commencement of the term of office of the new board of officers and standing Committees, the President delivered an appropriate annual address as follows:

ADDRESS OF PRESIDENT SPOONER.

Ladies and Gentlemen of the Massachusetts Horticultural Society:—Another year has passed, and we meet to exchange friendly wishes for that which is before us, and to recall with pleasure the successes in which we have all felt so much interest during the months that have left their treasures with us. Three of our principal exhibitions were remarkably fine; that in March, of bulbs, which were of high merit, and notably the Annual Show of Plants, which, even in the sultry month of August, aroused great enthusiasm among the lovers of the beautiful, long to be remembered. The meeting of the National Society of Florists, at that time, furnished a pleasant stimulus to our efforts in this direction, and the opportunity was certainly improved to the fullest extent. The members of that Society, representing the most intelligent cultivators of the country and so strongly influencing its commercial floral industries, were visitors who added greatly to the zest of the occasion, and the Committees having all arrangements in charge deserved high praise for their untiring energy in bringing together so large a number of exhibitors with their magnificent collections

of plants. Such opportunities as this furnish a good test of our capabilities, and show what we have acquired; each member is ready to do his best, and those who visited Music Hall during the August exhibition will need no reminder of the beautiful result.

In a financial point of view, the Chrysanthemum Show in November was by far the best of its kind ever held by the Society, and fully emphasized the fact that the public appreciate a good exhibition if it presents something out of the regular course, and is not a mere repetition of its predecessors.

A gratifying improvement has been apparent also in the weekly shows of the season, many of them being of remarkable excellence and giving the best incentive to our exhibitors to keep up the standard, each one striving still further to excel.

One of our members has suggested the value of membership in our Society, and how much he has enjoyed its privileges; instead of a membership of eight hundred, we ought to have on our list twice that number. Can we not each endeavor to bring in one or more new names to the list?

I am glad to notice by the report of the Library Committee, a more general use of the books. Our privileges in this respect are extensive; we have one of the finest libraries of its kind in the world; the rooms are pleasant and convenient, and it would be advantageous to promote social interchange and increase mutual interest in this beautiful science. These privileges not being restricted to members, and the competition for prizes being open to all, the liberality of the city and of the Commonwealth towards our Society is repaid in kind.

And this leads me to emphasize the importance of the meetings for discussion, as a branch of our work which deserves more attention from members, and which ought to attract public interest also. The papers read here are from practical and scientific men, upon subjects relating to practical Horticulture and Agriculture, and they deserve fuller notice by the press, which I hope our Committee may make arrangements to insure. The Chairman of the Committee says the TRANSACTIONS will in time become an encyclopædia of practical Horticulture. The delays which have occurred in preparing these transactions have been unavoidable, owing to repairs being made in the halls and library, during 1889, necessitating frequent interruptions to our Secretary's labors.

From the report of the Committee on Window Gardening we learn that its work has been actively continued, with apparent success, showing a gain in its missionary efforts which renders it worthy of continued support; its influences tend to increased information on the subject of our art, and ultimately perhaps to an increase of our membership.

I desire to call your attention to the World's Columbian Exposition, to be held in Chicago, in 1893,— a national celebration of such magnitude that it should receive the support of all. Horticulture should be fully represented in all its branches, in a distinct department, as such an Exposition could not be complete without this beautiful feature. Its large commercial importance justly entitles it to proper representation, and I trust that our Society as one of the oldest, will take measures at an early day to secure the opportunity of showing some, at least, of the achievements of Massachusetts Horticulture.

This Society has a representation in the State Board of Agriculture, and receives its annual bounty; as the Board holds an annual meeting of several days' duration in different counties of the State it would be an appropriate act of courtesy on the part of our Society to extend an invitation to the Board to hold its next meeting in Boston, with the free use of our halls for the purpose.

During the year the Society has lost from its membership, by death:

John S. Farlow, of Newton, an amateur cultivator on his large estate, and a frequent and valued contributor to our exhibitions. Mr. Farlow left by his will, a conditional bequest to this Society.

George Hill, of Arlington, one of our strong members, a man of sterling character; an exhibitor whose products were of the finest and whose place here will not easily be filled.

Mrs. Francis B. Hayes, widow of our late President, who was a large and constant contributor to our exhibitions, continuing to encourage the pursuits in which her husband had shown so much energy.

Warren Heustis, of Belmont, even within a few days has been stricken suddenly from among us, and will be greatly missed. He has been a valuable contributor in the department of fruits and vegetables, and a most successful amateur rose cultivator.

Stiles Frost, of Newton and Hermann Grundel, of Roxbury, were also members of long standing and of undoubted ability.

Also, Dr. Henry J. Bigelow, who became a member of our Society only a few months before his death.

The vacant spaces left in our ranks admonish us that we need to train up recruits for active membership. I am more forcibly impelled to urge this by the discovery, from reference to the records of membership, that less than one-half as many persons were admitted as members of our Society during 1890, as there were in 1889. It is, therefore, noticeable that while our exhibitions have greatly advanced in merit, our members have not proportionately increased, though it should, in justice, be said that the large accession in 1889, was chiefly due to the efforts of one member.

The finances of the Society are in a prosperous condition; the stores are under favorable leases, and the halls have been in frequent demand during the year, yielding good returns with judicious management. During the past year $10,000 has been paid on the mortgage debt, leaving a balance of $15,000 to be paid, and we have in the Sinking Fund the sum of $5,000. The John Lewis Russell fund, of $1,000, is permanently invested.

No expenditures of importance have been made upon the building, but some repairs to portions of the premises need immediate attention. The Treasurer's report, which is delayed for examination, will show gross receipts for the year of $48,781.39, including a balance on hand January 1, 1890, of $10,620.55. The total expenditures have been $33,559.31, leaving a balance of cash on hand December 31, 1890, of $15,222.08. There has been received from Mount Auburn Cemetery $5,360.44, included in the above amount.

Joseph H. Woodford, from the Committee appointed at the last meeting to prepare a memorial of the late Mrs. Francis B. Hayes, reported the following, which was unanimously adopted:

The Committee to prepare resolutions on the death of Mrs. Francis B. Hayes report the following:

It is with feelings of deep sorrow that we record the death of our associate, Mrs. Francis B. Hayes, which sad event occurred on the 20th of November, 1890, after an illness of a few months' duration. Mrs. Hayes was a woman of great activity, very hospitable and social in her domestic life, and remarkably sympathetic and benevolent toward the suffering and needy. She took up the grand work of Horticulture immediately after the death of her good husband, our late President, and continued it with

unabated energy until the day of her death, being all the time a constant and valued contributor to the exhibitions of our Society.

We cannot, therefore, permit the great loss that has befallen us to pass by without recording our appreciation of her many virtues and the great satisfaction she always experienced in contributing so often to the cultivation of the social element in our Society. Therefore:

Resolved, That by the death of Mrs. Hayes our Society has lost one of its most valued members, ever active in promoting the advancement of horticulture by her grand exhibitions at her own beautiful home in Lexington and in our halls, and by the great interest she always manifested in the social enjoyments of our Society.

Resolved, That we will cherish the memory of her noble deeds, her unselfish spirit, and her devotion to the interests of horticulture.

Resolved, That we tender to her afflicted family our sincere sympathy in this time of their great bereavement.

Resolved, That these resolutions be entered on the records of our Society, and that a copy thereof be forwarded to the family by our Secretary.

MRS. E. M. GILL,
MRS. A. D. WOOD,
JOSEPH H. WOODFORD,
} *Committee.*

John G. Barker, Chairman of the Committee on Gardens, reported the awards made by that Committee for the year 1890. The report was accepted and referred to the Committee on Publication, and it was voted that further time be granted the Garden Commitee to complete their report.

The President, as Chairman of the Executive Committee, reported a recommendation that the Society make the following appropriations for the year 1891:

For the Committee on Window Gardening, this sum to cover all incidental expenses of the Committee and to be paid through the regular channels, . . .	$250
For the Library Committee, for the purchase of magazines and newspapers, binding of books, and incidental expenses of the Committee, ...	300

For the same Committee, to continue the Card Catalogue of Plates, ...	$100
For the Committee of Arrangements, this sum to cover all extraordinary expenses of said Committee, .	300
For the Committee on Publication and Discussion, including the income of the John Lewis Russell fund, .	300
For the compensation of the Secretary and Librarian,	1,500

These appropriations were unanimously voted.

The appropriation of $6,800, for Prizes and Gratuities for the year 1891, recommended by the Executive Committee at the meeting on the first Saturday in November, came up for final action and was unanimously voted.

The Executive Committee also reported approval of the additional appropriation for the Flower Committee of 1890, voted by the Society at the meeting on the first Saturday in October, with the substitution of $272, in the place of $300, as it appeared from the Report of the Committee that the lesser amount is sufficient. This appropriation also was voted.

The Executive Committee also reported the appointment of Charles E. Richardson as Treasurer and Superintendent of the Building, and Robert Manning as Secretary and Librarian.

The Executive Committee also reported, in regard to the Circulars concerning the Preservation of Beautiful and Historical Places in Massachusetts, referred to that Committee by the Society at its last meeting, a recommendation that the Society pass the following vote:

Voted, That this Society expresses its hearty approval of the movement for the Preservation of Beautiful and Historical Places in Massachusetts, and will coöperate therein, and that a request be made that this Society be named in the act of incorporation to be asked for, for this purpose, and that the Society be represented by the President at such hearings as may be held at the State House on the subject.

This vote was unanimously passed.

Joseph H. Woodford moved that the Chairmen of the Committees on Plants, Flowers, Fruits, and Vegetables be paid $100 each, per annum. This motion was withdrawn by the mover in favor of

a motion by Ex-President Walcott, that a Special Committee be appointed to consider the subject of compensation of committees. The latter motion was carried, and the chair appointed as the Committee, Joseph H. Woodford, Henry P. Walcott, and Charles H. B. Breck.

On motion of E. W. Wood, it was voted to invite the State Board of Agriculture to hold its Annual Meeting, in December next, in the City of Boston; and to offer the free use of the Society's Halls for that purpose; and that the Secretary communicate this invitation to the Board of Agriculture.

On motion of Charles N. Brackett, the Chair appointed Mr. Brackett, Varnum Frost, and Charles F. Curtis a Committee to prepare a memorial of the late Warren Heustis.

On motion of Charles N. Brackett, the Chair appointed Mr. Brackett, Joseph H. Woodford, and E. W. Wood a Committee to nominate a candidate to fill the vacancy in the Committee on Vegetables, caused by the death of Mr. Heustis.

On motion of I. Gilbert Robbins, it was voted that the President appoint a committee of seven members, to revise the Constitution and By-Laws of the Society. The President stated that he would report the Committee at the next meeting of the Society.

O. B. Hadwen, Chairman of the Committee on Publication and Discussion, announced that the Schedule of Prizes and Programme of Meetings for Discussion were ready, and that a copy would be mailed to every member of the Society; also that the first of the Meetings for Discussion would be held on the next Saturday, when H. E. Van Deman, Pomologist to the United States Department of Agriculture, would speak on the work of his Division.

Adjourned to Saturday, January 10.

BUSINESS MEETING.

SATURDAY, January 10, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

Charles N. Brackett, Chairman of the Committee appointed at the last meeting to give expression to the feelings of the Society on the death of Warren Heustis, presented the following report, which was unanimously adopted.

The Committee appointed to prepare a memorial of the late Warren Heustis report the following:

The intelligence of the death of Warren Heustis, which occurred on Wednesday, December 17, came to us like one of those unexpected and startling calamities which occasionally arrest our thoughts, and remind us how true it is that "in the midst of life we are in death." Suddenly and without premonition, in the fulness of his strength, he has been called from the scene of his earthly labors which he has so long dignified and adorned.

For thirty years he has been a constant and valued contributor of Fruits, Flowers, and Vegetables at our exhibitions, has been frequently called to serve on important committees, and at the time of his death was a member of the Vegetable Committee, having served in that capacity for eight successive years. He was a very successful cultivator, and was the orginator of the famous Belmont seedling strawberry. Mr. Heustis was also very fond of flowers, particularly the Rose, the love for which amounted, with him, almost to a passion. He was a man widely known from the interest which he took in agriculture and all that pertains to its kindred arts. His circle of friends was large and his loss will be greatly lamented. He was gentle and unassuming in his manners, discriminating and sound in his judgment, and firm in his opinions, though he never pressed them upon his listeners. He always advocated what he believed to be right and just, without fear or favor to any. He was fond of rural life and found his chief enjoyment in the bosom of his family and in the congenial occupations of his farm.

It falls to the lot of few men to enjoy in this life a greater measure of respect and confidence than Mr. Heustis secured from those around him, and now that he has gone he leaves behind the precious memory of an eminently pure, useful, and honored life.

In view of his long and useful services to this Society, his many excellences as a man, and the interest he has always manifested in the welfare of our association, the Massachusetts Horticultural Society desires to place on record its appreciation of his services and its high respect for his character and memory. Therefore,

Resolved, That in the decease of Mr. Heustis there has been removed from our circle an active and devoted friend of Horticulture, whose interest in the work of the Society continued through a long and active life, and ceased only with its close.

Resolved, That these proceedings be entered on the records of the Society, and that a copy thereof be sent to the family of the deceased with the assurance of our warmest sympathy in their great affliction.

C. N. Brackett,
Varnum Frost,
C. F. Curtis,
} *Committee.*

The Chair announced the Committee on the Revision of the Constitution and By-Laws provided for at the last meeting, as follows:

I. Gilbert Robbins, Leverett M. Chase,
Francis H. Appleton, John G. Barker,
Henry W. Wilson, O. B. Hadwen,
Robert Manning.

On motion of Ex-President William C. Strong, it was voted that the President be added to the Committee as Chairman.

On motion of E. H. Hitchings, it was voted that agreeably to the rules of the State Board of Agriculture three prizes of $10, $8, and $6, be given for the best reports of awarding committees, and that the Committee on Publication and Discussion be requested to award these prizes.

The Annual Report of the Treasurer, for the year 1890, approved by the Finance Committee, was read by the Secretary, accepted, and ordered to be placed on file.

Adjourned to Saturday, January 17.

MEETING FOR DISCUSSION.

The Work of the Pomological Division of the United States Department of Agriculture.

By H. E. Van Deman, Pomologist, Washington, D. C.

In accepting the very cordial invitation to address you on this occasion I feel both honored and gratified at being able to meet with one of the oldest and most useful Horticultural Societies in

the country. The subject suggested by your Committee is the work which is placed in my official charge as chief of the Pomological Division of the United States Department of Agriculture, and as I understand it, this is to be suggestive of a discussion of the subject in general at this time. I do so with the more pleasure as I feel sure that ideas will be advanced and criticisms made which will doubtless result in good to the cause of Pomology. It is not necessary that my paper should be long, but rather that I merely touch upon some of the leading thoughts in connection with the work.

It is but little more than four years since the establishment of this Division and the appropriations for its use have thus far been so very small that it has not been possible fully to execute many plans begun, nor prudent to inaugurate others that I have long had in mind. The original purpose of its institution and organization was to do work that cannot in the nature of things be done by the pomological and horticultural societies of the country; and this has been closely followed. It is our constant effort to supplement and assist wherever and whenever possible and thus further the good cause which ennobles manhood, elevates our purposes and makes more delightful the realities of every day life. The good done to the world by Mr. Ephraim W. Bull, of your State, in placing before the public the Concord grape, will never be more than slightly appreciated. It has not only made that variety plentiful and cheap in the markets but it has brought the high-priced and higher flavored Delaware and Catawba within the reach of the humblest daily laborer who toils in the factory or at the forge. If the Pomological Division can be the means of bringing from obscurity some fruit of even less value than the Concord grape it certainly will not have existed in vain.

Among the things that we are trying to do is the *investigation of the wild fruits.* No part of either temperate zone is so richly endowed by nature with wild fruits of such intrinsic value and so susceptible of improvement as the United States, and yet we have only begun their improvement. The cultivation of only four of the twenty-five species of our wild grapes has been attempted and this in a limited degree.

For three years past Professor T. V. Munson, of Denison, Texas, has been working in conjunction with the Division in preparing a monograph which shall cover the entire genus Vitis, as

found growing wild in North America. Already a preliminary report has been issued upon this subject, which I presume has been received by all the members of this Society. The work upon the complete monograph is progressing, but it is necessarily very slow, as the preparation of the illustrations is exceedingly difficult and the field work necessary also requires much time. At the present time we are nearly ready for publication, and the greatest obstacle we meet is in obtaining the necessary appropriations to defray the cost of publication. All the species will be represented of life size and in life colors, including the fruit, wood, leaves, flowers, seeds, etc., so that any person of ordinary intelligence may identify such of the wild grapes as may grow in his vicinity. The text will contain not only accurate scientific descriptions, but cultural notes and suggestions as to the hybridization, etc., for the purpose of enabling those who desire to experiment to proceed more intelligently than without such aid.

The berries have, so far, yielded the most easily to the hand of man, but the tree fruits are also well worthy of more attention than has been bestowed. The whole genus Prunus, as represented in North America has been only recently and but slightly improved, and this merely by the selection of chance wildings. The few native plums thus obtained give promise of much greater things in the future, and to this end it is my purpose to monograph this genus and not only describe and illustrate each native species but try to show what might be done by crossing them with each other and possibly with the common cultivated plum of Europe, *P. domestica*.

When we think of it, it is really surprising how little is known of even our commonest fruits. Who can tell the season of the Baldwin apple in Massachusetts, Ohio, Tennessee, and Texas; or when the Concord grape will ripen in northern Michigan, Kansas, and Florida? If ten of the leading strawberries ripen in Connecticut in a certain order will they do the same in Virginia and California? Why are the same varieties of the orange thicker-skinned and more acid in flavor grown in California than in Florida? These are only specimens of thousands of such questions which are not only of interest to the scientific pomologist but which would be of practical value to the grower if answered from reliable data. A beginning has been made, as no doubt nearly all of you know, by issuing circulars calling for information

which will enable us to prepare special reports upon the apple and the small fruits. Unfortunately the season was unfavorable to the apple last year, over a large part of the country, and it will be necessary to issue another circular this year on the same subject, as it would be unwise to attempt a publication without comprehensive information, and this it has not been possible for our correspondents to give during the past year.

The other fruits are to be treated in a similar way if my purposes are carried into effect. All this requires much thought in preparing the questions and collating the returns and getting them into readable shape. The time and skilled labor necessary in accomplishing this is expensive and could not be borne by any of the state or national societies, and as it is public work it should be paid for out of the public funds. What more legitimate use could be made of the taxes paid by horticulturists? The mere clerical work is a burden that only the general government can and should bear. It has been my invariable rule in selecting clerks, to employ only such as have a natural inclination to pomology combined with a reasonable amount of education acquired both in the class room and in the field of practice, that they may know what they do and also be in love with their work. So far, all the six persons employed in the Pomological Division have been reared in, and taken from the country, and so far as I control the Division there will be none other.

The employment of special agents outside the office has only been possible in a few cases but they have been eminently useful in gathering facts. At present, Mr. John S. Harris, of Minnesota, is investigating the hardy fruits of the Northwest and the Russian apples in particular; also Mr. T. T. Lyon, of Michigan, whom you all know as an able pomologist, is a regular employé of the Division, and at the present is visiting the state horticultural societies of the West, to assist in naming their fruits, participate in their discussions, and endeavor to arrange a system of reciprocity between the national, state, and local societies and the Pomological Division. It is hoped that by this latter means, in due time, much good may be done directly to the fruit growers by collecting and disseminating information through our reports and otherwise. It is especially desired to coöperate with the societies in all possible ways and if anything can be done in this direction with and for your State, I trust it will be brought about.

The proper naming of fruits is a matter which demands our most strenuous and intelligent efforts. Confusion abounds in the field of practical pomology, and if proper skill and authority can be brought to bear in an opposite direction, who will not be glad? Your venerated Wilder, whom we all love to honor, did all he could to simplify names and eliminate synonymes from the nomenclature of fruits. The reform which the American Pomological Society has commenced is an outgrowth of his views, and is well worthy of extensive application. I have delivered before the American Nurserymen's Association a strong appeal to have that body take some action which shall lead nurserymen to adopt in their catalogues the approved names, and thus carry into effect that which the American Pomological Society has so ably begun. In fact, if the nurserymen do not do it no one can. They are the teachers of the public in this regard.

The Nurserymen's Association in their meeting in Chicago, in June, 1889, accepted the truth of the charge that nurserymen often misinform the public as to the true names of fruits (and the same is perhaps true of flowers); but they thought the task of reform too great and no plan was adopted. Of course, whatever is done must be largely or entirely advisory and not dictatorial, and for the purpose of carrying the rules and corrections of the American Pomological Society into practical application I have promised to arrange to have every fruit catalogue corrected in my office, so as to accord with the above idea, and return it to the nurseryman for his approval and final adoption. Thus would progress be made and simplicity and uniformity rule where chaos now is. It would, however, remain to be seen whether the nurserymen would accept the corrections as authoritative. If any one can suggest a better plan I shall most gladly use my best efforts to advance it.

One of the most arduous tasks which I have to perform in the course of my official duties is the naming of varieties which are sent in for identification from all parts of the country. Within the past year more than ten thousand such specimens have been received and passed upon and I am happy to say that in nearly all cases it has been possible to make satisfactory answers. How much of such work has been done by Downing, Warder, and many others at their own cost of time; and often of express bills, small individually, but large in the aggregate, to say nothing of

postage. We have the free use of the mails, and not only letters but packages of specimens go under our frank. I have on hand boxes and franks which will be sent to any person requesting them, thus enabling him to forward any specimens appertaining to to pomology which he may think of interest or may desire to have identified.

One of the first things which I attempted officially was to arrange and have adopted by the state horticultural societies, especially those near each other or having common interests, a system of holding their regular meetings in succession. It is evident that such an arrangement can be only beneficial, as persons wishing to attend the meetings of neighboring States can do so, whereas, if they met at the same time this would not be possible. It also affords opportunity for several societies to engage the services of the same lecturer, whose abilities may be of such a character that his presence is needed in more than one State. I am happy to say that with few exceptions this plan met with approval. In a few cases it was necessary to have the legislatures pass special amendatory acts and in others the constitution of the society had to be changed.

In the course of our official work we obtain information concerning a great many new seedling fruits that have never been heard of except in their native localities. There are many others which might have been found had we been able to make the necessary investigations. To bring these from obscurity and place them where they will be tested is a work that all will agree should be performed. In many cases very little expense would be necessary either in the way of time or money.

I have long endeavored to secure an appropriation that shall enable me not only to collect and distribute these nameless fruits, thus placing them where they may be of some use to the world, but to purchase scions, cuttings, plants, etc., of fruits that are already somewhat known, and distribute them in places where they may be likely to prove valuable. I am sorry to say that so far my efforts have been wholly in vain. The representatives of the people in Congress are their public servants, elected for the especial purpose of serving their constituents, and it certainly would be in no wise improper for the fruit growers of this country to suggest, and perhaps even demand, that something of the kind just mentioned be done.

It is with great pleasure that I can state that within the past few years I have been able to introduce from foreign countries several fruits which have never appeared on this side the great oceans except in their manufactured forms, and which give promise of success in this country. Among these I might name the Citron of commerce, which until within the past year has only been represented by an occasional seedling tree in the southern parts of Florida and California. Not one ounce of American preserved citron is to be found, and yet there is no good reason why all that is needed by our people may not be grown within the United States. Thirteen of the very choicest named varieties were procured from Palermo and Catania, on the Island of Sicily, and from Naples on the mainland of Italy. These were budded from bearing trees at my special order given through the Department of State. Other varieties have been ordered from Bastia, on the Island of Corsica, where, it is said, the very best citrons are grown and shipped to Leghorn, where they are preserved and whence the product is sent to market.

It may not be generally known that in the southern parts of California, Arizona, New Mexico, and Texas there are millions of acres which can be made to produce Dates of as good quality as those grown in Arabia and Persia. Believing this I sent to the date growing regions for rooted suckers from the best named varieties in existence, and within less than one year from the date of this order, which was also given through the Department of State, sixty-three plants were safely landed on our shores, and are now planted in the region before mentioned, without the loss of a single one. In due time it is expected that others will be received. All former efforts to secure rooted suckers of the date have failed, for the simple reason that they were not planted in tubs of earth and well established and then sent in this condition. All the dates growing in the United States, previous to this importation, are seedlings, and, as is the case with other fruits, there is no certainty as to what variety of fruit will be produced in this way; and not only this, but as the date is a diœcious tree there is no certainty as to which sex will be produced. One case, in Florida, has come under my notice, in which five trees were carefully watched until they grew to large size, when all proved to be males. Aside from this, it is certainly advisable, if we begin the culture of the date as an article of commerce, to begin where the Arabs, the

Persians, and the Syrians left off, by procuring the varieties which have come down to them through thousands of years of careful selections.

The Mango is another fruit which has until recently been represented on this continent only by a few seedling trees, but I have procured from India grafted plants of a number of their very choicest varieties. These are now in southern Florida, where they are being propagated on young seedlings, and when ready for distribution they will be placed in the hands of those who are likely to succeed with them.

There is not a pound of Filberts in any of the stores of the United States that has not been imported, and it has occurred to me that our own people might produce what our markets demand, if the original stock were placed in their hands. With this purpose in view I have endeavored to procure from Europe and the British Islands plants and fresh nuts that a thorough test may be made as to their adaptability to this country. The Puget Sound region seems to be a suitable place for this experiment, as the climatic conditions are fully as good as those in Kent, England, where a large part of the filberts found in our markets are produced, and I think the soil is better. There are doubtless other places where they will succeed quite well. These are only a part of the new fruits which I have already been able to procure through our foreign consuls; and it may not be out of place to say in this connection that, although some critical persons may think that our foreign representatives are gentlemen of only political abilities, I have been convinced by numerous practical demonstrations that, as a rule, they are wide awake to the industrial interests of this country. In every case in which I have made application to them through the Secretary of State, I have been able to secure just what was desired or to get information that it was impracticable to do so.

It may seem to some persons that the central part of our country has been overlooked in the procuring of these foreign fruits, but I assure you that this is not the case. Europe is the principal field which can be worked to obtain such fruits as will endure the climate of a large part of our country, and it has been gone over and over for centuries past and very little remains there worthy of introduction. Asia presents a much better opportunity, and if possible we may yet be able to get many valuable things

from there. Allow me to say in this connection that although it may seem a special favor to Florida, California, or Oregon to give them a fruit which they alone can grow, it is, nevertheless, a benefit to the whole country. Does the grower of the Washington Navel orange at Riverside, California, monopolize its good qualities, or does the citizen of Boston share with him? If the Alphonse mango, which is the delight of the resident of India, as he sips its sweet juices on the veranda of his bungalow, can be grown at Lake Worth, Florida, will not the express train land it in New York or Minneapolis in good condition, and thus bring the ends of the earth together? In these days of rapid and safe transit for tender fruits, all sections of the country can be supplied with such things as before were denied to all except those who lived in the favored regions where they grew.

The field opens as the work progresses. The Division of Pomology is now firmly established as a part of the government service and I trust that it may serve the fruit growers of our whole country in a satisfactory manner. Upon them, in part, lies the burden of responsibility as to its conduct, and I frankly invite criticisms and suggestions which shall lead us forward.

Discussion.

O. B. Hadwen was much gratified to hear Mr. Van Deman's statement of the work of the Pomological Division of the United States Department of Agriculture. It is a matter of surprise to many to learn how vast is the amount of fruit, and how almost innumerable are the varieties now grown in our country. It is a leading object of this Society to encourage the production and general introduction of new fruits and vegetables, but perhaps we have been remiss in bringing into notice some excellent new fruits. Fair specimens of new seedlings can be produced in five years, but we cannot depend upon their good qualities being established without several years of trial. He declared his belief in a definite term of life in fruits as in other organic forms, and in this respect some new fruits have too short a term of life to be of much value.

E. W. Wood was interested in the paper just read, but he did not think it affected New England. The work of introducing new fruits here depends largely upon amateurs, as those who grow fruit for market do not find it profitable to go outside of the standard

kinds. The three apples most grown here for sale are natives of Massachusetts. He holds as an axiom that varieties of fruits most profitably grown for market succeed best in the places where they originate. Alluding to the Concord grape, he said he was convinced that this improvement upon the wild grape came from a native. No grape crossed with foreign varieties is desirable for market purposes. The Concord is almost as reliable as any other fruit, except when the season is very backward. The Worden is somewhat earlier and is more popular. There is one advantage in growing new small fruits in that they can be tested sooner.

Professor L. R. Taft, Horticulturist at the Michigan Agricultural College, expressed great pleasure at being present at this meeting. He was very glad to hear from Professor Van Deman how well the work of the Department is being amplified in all directions, and that the Division of Pomology is making such progress, especially in fruits for the different climates of the United States. Through these efforts he hoped some new varieties would be found that would prove valuable for Northern Michigan. His state, he said, is an empire in itself, extending five hundred miles from its southeast extremity to its northwest, and it is a hard matter to find fruits suited to all its phases of soil and climate. While the common standard varieties succeed admirably in the southern half of the state, and in almost any section bordering on the lakes, *ironclad* sorts are needed for the northern peninsula, and for some fifteen counties in the southern.

The Michigan Agricultural College has been testing fruits of various kinds, and has found some Russian apples which are certainly hardy and are said to be productive and to furnish fruit of large size and high quality. These tests were made at various sub-stations in northern Michigan, the principal one being at Grayling, Crawford County, where some fifty varieties of apples, besides pears, plums, and cherries have been planted. At the College they have just planted an experimental orchard of five hundred varieties of apples, pears, plums, cherries, and peaches, and there are very complete collections of the newer varieties of small fruits. In addition to a number of sub-stations in southern Michigan, the station has at South Haven what is known as the Lake Shore sub-station, conducted by T. T. Lyon, President of the Michigan State Horticultural Society, and a special agent of the Division of Pomology.

In Strawberries, a very extended list of varieties has been tested, some of which appeared remarkably successful. The speaker mentioned Bubach's No. 5 (pistillate), as taking a high rank, but requiring rich soil and good culture; Haverland (pistillate), as very prolific; Parker Earle (bisexual), from Texas, as an excellent sort; and Warfield (pistillate), as in the front rank at present.

The work of the Experiment Station in Michigan is in charge of the President and six members of the faculty of the Michigan Agricultural College, each of whom is responsible for the work done in his own department.

As few persons are familiar with the scope of an Agricultural College, he wished to say that in addition to the instruction given by lectures and otherwise, in agriculture, horticulture, veterinary science, etc., the students receive a thorough training in the natural sciences, mathematics, languages, and literature; and even if they do not become farmers it will be of value to them in any calling. For any practical business life, or even for the professional man, a course at some agricultural college, like those of Massachusetts and Michigan, will be more valuable than one at Harvard or Yale.

A unique feature of the Michigan Agricultural College is that every student is required to work two or three hours each day, either on the farm or in the gardens, and thus practically work out the subjects taught in the class room.

William C. Strong said he had enjoyed the paper very much. He was glad to be so fully informed concerning the work and methods of the Pomological Division of the Agricultural Department at Washington, and he thought it would be well for us to consider ways and means by which to forward that work. It interested him to know that there is a central authority looking over the whole field, to gather in and disseminate information in all the divisions of this Department of our government. Such an agency can do very much to improve as well as to increase production, and thereby largely promote the welfare and happiness of the people. As an example, how much more abundant oranges are now than formerly. This is a fruit which can be produced easily,— perhaps more easily in this country than in any other. Through the labors of this Division of Pomology we may expect better knowledge of how to improve the quality and quantity of our present fruits, and also the successful introduction of other

fruits, such as the mango, etc., which are now almost unknown as products of our own country.

Benjamin G. Smith did not agree with Mr. Wood. He differed with him in regard to the Rogers Hybrids for amateurs. He has fifty-five varieties of grapes, including the Wilder, Barry, Salem, etc. He wished to speak a word of encouragement to amateurs as to the treatment of choice varieties of grapes. He always covers his vines in the winter, first pruning severely; but if these vines are neglected they will certainly mildew. He had tested fifty-four varieties of choice grapes, and his final decision is that, all things considered, Moore's Early is the best for general culture.

Samuel Hartwell said that he has perhaps twenty varieties of grapes, but not more than four or five of them are profitable to grow for market. Moore's Early is most profitable, as every grape in a bunch will ripen. The Worden is a very fine grape but it will not ripen so evenly. Purple grapes sell better than white varieties. The Hayes, Esther, and Pocklington are fine sorts; the Niagara is inclined to dry rot, and the Brighton, Amber Queen, and August Giant, are liable to mildew. Some white grapes, the Niagara for instance, come to maturity later and command prices less than half that of Moore's Early. He intends to plant the Worden between these white grapes and as the new plants come on will cut out the old and less desirable white ones. He pronounced the Gravenstein to be the queen of fall apples; every one is perfect and fit for market. He was pleased with the Red Bietigheimer — for cooking only — its size and quality holding it very much in favor. Oldenburg is very productive. The Baldwin originated in this state long ago, and it seems to be deteriorating a little.

William H. Hunt was very much pleased to know what the Agricultural Department is doing. His own experience with grapes had been similar to that of Mr. Hartwell. The statement that fruits succeed better in the neighborhood of the place where they originate is true to a certain extent, although there are many exceptions, of which the Gravenstein apple and Bartlett pear are conspicuous examples.

Mr. Strong asked if we are not liable to carry the question of color a little too far. We should give the black a fair chance, but should it have preference over the white? The reason might be, in some degree, that we do not produce as fine bunches of white

grapes as of black and this may partly account for the preference in the market.

Mr. Wood said he has in his grape house eighteen foreign grape vines, with one Golden Hamburg at the end of the row of seventeen colored. When he sends the crop to market, he finds the one white grape vine has supplied quite as large a proportion of the fruit of that color as is desired.

Mr. Strong said that he formerly grew the Muscat of Alexandria and always got the first prize for it. The Golden Hamburg, however, is not of as high quality as the Muscat of Alexandria.

Mr. Wood considered the Golden Hamburg as good as the Black Hamburg or Wilmot's Hamburg. He had found that white currants do not sell as well as the red varieties.

Mr. Van Deman held that the reason white grapes are less profitable than dark colored fruit, lies in the fact that although white ones do not bruise any more than the others they show their bruises more, and look damaged while the dark ones appear fair. This inference is based upon statements of dealers,—wholesale and retail. In Florida they are planting the Niagara grape by ten acre lots to supply the demand for this fruit. Some are sold to wealthy persons at high prices to make a fine show on their tables, but the general market does not seem to want them in large quantities. As to quality they are quite as good as many dark varieties.

Richard P. Walsh, who had had fifty-five years' experience in gardening, said that while located about twenty miles south of Boston, and ten miles from the sea, he received, with other trees and shrubs from a Rochester, N. Y., nursery, a Purple Hazel, grafted upon a plain hazel stock. The latter was very thrifty and threw out suckers, which were at first cut away, but as the green mingled with the purple foliage was a pleasing combination both were allowed to grow. After two years the purple was choked out, and then the stock produced nuts which proved it to be the true Filbert, *Corylus Avellana*, and a crop of nuts was gathered each succeeding year thereafter. From his observations of both stock and scion, he was convinced that they were both perfectly hardy there. He said they could be grown in hedge-rows, and required but little cultivation, and he was confident that they would succeed in the neighhood of Boston.

Robert Manning said that a few years ago he set out several filbert bushes, one of which produced fruit last year. He showed

some of the nuts at the Annual Exhibition of Fruits last September. The plants seemed perfectly hardy, and the success of the experiment was encouraging, though one of the bushes had been injured by what he thought was probably the same fungus which has done so much damage in England.

Mr. Van Deman's paper was listened to with close attention and a vote of thanks to him for his interesting lecture was unanimously passed.

The Chairman of the Committee on Publication and Discussion announced that on the next Saturday, Ex-President William C. Strong, of Newton Highlands, would present a paper upon "Evergreen Trees."

BUSINESS MEETING.

SATURDAY, January 17, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

M. B. Faxon, Secretary of the Committee on Window Gardening, read the financial portion of the report of that Committee, which was accepted and referred to the Committee on Publication.

E. W. Wood, from the Committee of Arrangements, to which was referred a circular from the Michigan Horticultural Society, in regard to the classification of the Horticultural Department of the World's Columbian Fair, reported a recommendation that this Society approve the classification recommended by the Michigan Society. The report was accepted and the recommendation was adopted.

Francis H. Appleton, from the Committee on Publication, to which was referred the subject of the Society's Diploma, reported a recommendation that copies be made by the heliotype process. The report was accepted and the recommendation was adopted.

Adjourned to Saturday, January 24.

MEETING FOR DISCUSSION.

Evergreen Trees.

By William C. Strong, Newton Highlands.

In assigning this subject for discussion, it is presumable that our Committee intended to limit the list to such trees as are hardy and adapted to this latitude. What are commonly called the broad-leaved evergreen trees, such as the American Holly, the *Kalmia latifolia*, and Rhododendrons, would properly come within this list, but the field is too broad to be covered in the time allowed for this session. Therefore, with the single allusion to the bright, fresh, polished green foliage of the Kalmia, which should be more appreciated for its fine winter effect, I propose to confine my remarks to such of the conifers as seem to be of promise for culture in New England. Looking back but a few years, we should find this list quite limited in numbers. But a marked advance has been made within the present generation, including numerous and valuable introductions from the western coast of our own continent, as well as from Japan and other countries, so that we now have a largely increased number, and also very distinct colorings and habits of growth. What an immense gain it is to us that in our cold, desolate winters, we can vary and enliven the evergreen effect by the addition of the glaucous sheen of some of the newer Firs, with the richer green of the Nordmann, the distinct form and color of the Sciadopitys, or the varying grace, in form and color, of the family of Retinosporas! By a judicious use of such material as we now have, a warmth and variety of verdure and a diversity of outline may be given to a landscape, or to a country home, far surpassing the possibilities of a few years ago. In saying this it is not to be inferred that the older kinds are to be displaced, or even reduced to a subordinate rank. They are still the basis of all good work in planting, but they are happily supplemented by recent varieties of differing forms and colors, so that much richer and more pleasing effects can now be produced. Let us briefly mention some of the indispensable older kinds.

Our native White Spruce (*Picea alba*), often called Blue Spruce, is one of the hardiest and most pleasing of conifers. Its conical, thick-set shape, and its light and more or less glaucous foliage render it always a favorite. Though not so long-lived or so valu-

able for timber as the nearly related species, the Black Spruce (*Picea nigra*), it is far more desirable for ornamental purposes and should be in every collection. Individual seedlings can often be found which are quite distinct in form and color, Maxwell's Golden being a good example.

The Norway Spruce (*Picea excelsa*), though a foreigner, has yet become so common and is so perfectly at home with us that we have come to regard it "as to the manor born." However common and perhaps formal and monotonous when repeated in numbers, it is yet so hardy and vigorous in nearly all soils; so fine in single specimens, with graceful, pendulous branches sweeping to the ground; so well adapted for hedge-rows or shelter belts,— in short it has so many good qualities that it is not out-ranked by any other conifer, for landscape work. It varies considerably in habit and we have these sports perpetuated in such distinct forms as *P. inverta* and *P. pendula*, or in grotesque habit like *P. monstrosa*, or as a dwarf like *P. Clanbrasiliana*, *P. Gregoriana*, and *P. pygmæa*.

Our White Pine (*Pinus strobus*) is probably the most profitable of all trees for timber, in our light soils. It does not thrive in a wet soil. But we have thousands of acres of comparatively waste land which should be planted with this species, and it would be a wise economy to give government encouragement to this industry. For decorative purposes the White Pine is also valuable, its soft, silvery green foliage furnishing a pleasing contrast with the more rugged and darker growth of other species.

The Bhotan Pine (*Pinus excelsa*) has longer, more graceful and drooping leaves than the White Pine, but it is liable to blasting of its leader and its branches. In other respects it is vigorous and hardy and its superior beauty entitles it to an attempt to overcome this tendency.

The Austrian, the Scotch, and the Cembran or Swiss Stone Pines are each well-deserving the general use which they receive. They will not vie with the White Pine for timber use, though in conditions where the older growth continues healthy they will have value in this respect.

The Red Pine (*Pinus resinosa*), often, but incorrectly, called Norway Pine, is a very hardy, native tree which flourishes in a dry, sandy soil, from the Middle States into Canada. It abounds in resin, is of value for timber, and deserves a place in a collection, as an ornamental tree.

Our Pitch Pine (*Pinus rigida*), though very hardy and free-growing, is scarcely deserving a place in cultivation, in comparison with better varieties.

Our native Hemlock, *Tsuga* (*Abies*) *Canadensis*, when planted in exposed positions is very apt to suffer from the winter winds. If it were a recently introduced novelty it would be pronounced one of the most graceful and beautiful of conifers, but too tender for ordinary positions. Yet it is in fact one of the commonest timber-trees of New England and Canada. This shows to what a degree hardiness depends upon proper conditions and how careful we should be to make sure that these conditions are complied with, before we pronounce judgment upon the question of hardiness.

Of the Silver Fir tribe, now classed as *Abies*, (*Sapini* of Veitch) the native Balsam Fir is the only variety which may be said to be common in New England. Young specimens are very beautiful, especially in the northern sections of its growth. But it is subject to diseases in this vicinity, is short-lived, and must give place to much more desirable varieties of this class of Silver Firs, of recent introduction. A dwarf Balsam Fir, named *Hudsonica* by Dr. Engelmann, is found in the White Mountain region and in Maine, which is quite prostrate in growth, and roots from its branches like the prostrate Juniper.

The various forms of the Arbor Vitæ (*Thuja occidentalis*) are in frequent use and are essential in all collections. The so-called Siberian variety is given by Veitch as *Thuja plicata*, coming from the neighborhood of Nootka Sound and Siberia. Hoopes, however, quoting from "Gordon's Pinetum" considers it as having originated at Ware's Coventry nursery and therefore to be called *T. Wareana*. In the latter case it is to be regarded as but a fixed variation from *T. occidentalis*, differing mainly in hardiness and compactness of growth, qualities which make it very desirable for many purposes.

The Savin (*Juniperus Virginiana*), varying much in form, color, and habit of growth in different seedlings and often very attractive, will complete the list of conifers in common use up to a comparatively recent date.

I will now mention some of the more desirable additions which have been made within the past few years, without any attempt at a complete list, and will then pass to consider a few points in culture, which I deem to be important.

The Silver Firs will rank as among the most desirable ornamental trees. The European Silver Fir (*Abies pectinata*) is scarcely hardy with us, except in protected places, but the closely allied *Nordmanniana* is quite hardy and thrives well, with the single fault of liability to lose its leader. Its stately habit and dark, rich, glossy green foliage render it one of the handsomest of conifers.

Abies concolor is a more recently introduced fir from Colorado, its type in the Sierras of California being known under the names of *lasiocarpa* and *Lowiana*. Its name *concolor* implies the like silvery color on the upper and under sides of the leaf. It is one of the stateliest trees of the Rocky Mountains, and retains its beautiful color in old age. As the type from Colorado seems to be quite hardy and to be suited to our climate, it bids fair to become one of the most useful and desirable of the recent introductions. A magnificent specimen may be seen at Wellesley in the collection of Mr. Hunnewell.

In the same collection is a fine specimen of the Japan Silver Fir (*Abies brachyphylla*). It proves to be one of the hardiest and handsomest of Firs, its two under silver lines being quite conspicuous.

Abies Cilicica is reported as not accommodating itself to the climate of England. It has done well in this country, however, a good example of it being also in Mr. Hunnewell's collection. This is proof that some varieties may be better suited to our climate and therefore more hardy than even in England. It is only by trial under various conditions that we can determine hardiness. This rule will apply to the three following firs of our northwest coast.

The great Silver Fir (*A. grandis*) attains to the height of two hundred feet and upwards, along the Fraser River and Vancouver's Island, and at altitudes of four thousand feet. Its branches are slender and less thickly set than in most, and hence it has a light, graceful, and airy appearance which is very desirable.

Abies amabilis is reported by Professor Sargent as growing freely on the Cascade Mountains and as far north as the Fraser River in British Columbia, and as the most beautiful of the genus with which he is acquainted. As it grows at altitudes of four thousand to five thousand feet in this northern latitude we are not without hope that it may be domesticated with us.

Abies nobilis has a more southern range, growing in Oregon and California to the same immense height, and being very conspicuous for its deep, glaucous-green, thick-set, crowded foliage.

These three magnificent firs have a mountain habitat and it is too early to speak decisively of their fitness for our climate, but they are eminently worthy of careful trial.

The Douglas Fir (*Pseudotsuga Douglasii*) or false Hemlock is another giant of the northwest, being a principal tree of the vast forests of British Columbia, and attaining a height of two hundred and even three hundred feet. It has had extended trial and may be pronounced hardy and decidedly ornamental, when planted in a moderately dry soil. The type from Colorado has never suffered from the winter with me.

I am not aware what trial has been made with *Tsuga Albertiana*, the Hemlock of British Columbia. The type is distinguished from our common Hemlock only by its more robust and rapid growth and spreading branches. It succeeds well in England, and coming from such northern limits it is reasonable to hope it will prove more hardy and desirable than *T. Canadensis*.

Of the family known as Spruces, now classed as Piceas, decidedly the most promising recent introduction is *Picea pungens*. It has also been known as *P. Engelmanni* and *P. Parryana*. It has a wide habitat, extending from New Mexico to the head waters of the Columbia River, its Colorado type being found to be perfectly hardy and suited to our climate. Its growth is stiff, very thickly covered with rigid, very sharp pointed leaves, from which it derives its name. It varies considerably in color from deep green to steel blue, or lightest silver. Its remarkable color and regular outline render it one of the best of conifers for the lawn. Fine specimens of this tree may be seen at the Arnold Arboretum, and also on the estates of Professor Sargent and Mr. Hunnewell.

Menzies's Spruce (*Picea Menziesii*) is a tree somewhat similar to the last, though less in degree of characteristics. It deserves a place in a collection.

The Oriental Spruce (*Picea orientalis*) of the Caucasian region is quite hardy with us, its foliage being of a bright, glossy green and its slender branchlets giving it a distinct pointed outline.

Of the Pine family I will mention only the Corean pine (*Pinus Koraiensis*) as being specially useful for decoration. It has long, glossy green foliage, silvery within; its habit is compact, dividing into numerous branches when about twelve or fifteen feet high, rendering it most suitable for positions where taller varieties would be undesirable.

The Umbrella Pine of Japan, as it is commonly called (*Sciadopitys verticillata*), is the most distinct of all the additions to our list of hardy conifers. It is remarkable not less for its form and habit than for the length and color of its leaves, which spread out like the ribs of a parasol. It has gained in reputation for hardiness, especially if somewhat sheltered, and since its effect is so distinct and excellent it will doubtless become very popular. Its habitat is limited to a mountain in the Island of Nippon, but it is being cultivated and distributed by the Japanese, as also in Europe and in this country.

To the Japanese we are also indebted for the introduction of the family of Retinosporas. This has now come to be a numerous and important class, owing to the many garden sports from the two original Japanese forms, *obtusa* and *pisifera*. Most of these are quite hardy in a moist and not too exposed situation. They are of moderate size, or low growing, with the exception of *obtusa* and *pisifera*, and since they give great variety in color and form they are much in use for garden work. We have the graceful, pendulous growth of *filifera;* the soft, silvery dew of *squarrosa;* the rich green of *plumosa;* and the bright, golden colors of *obtusa aurea* and *pisifera aurea*. For decorative purposes they are important acquisitions.

From the same prolific source, the Islands of Japan, we have received the *Thujopsis dolabrata*, a beautiful tree, resembling the Thujas, as its name implies, with short, thick, imbricated leaves, dark green above and glaucous beneath. It forms a conical tree from forty to fifty feet high, with extending pendulous branches sweeping to the ground. Though not generally distributed, it has proved hardy in several exposures and it well deserves extended trial.

Of the Junipers we may mention *Cracovia* as a desirable, hardy, erect, robust variety of *Juniperus communis*, and also *J. Virginiana glauca* as specially fine in color and form.

Without dwelling longer upon the list of varieties let us pass to consider some points in culture. First of all I wish to speak of the

Time for Planting.—The impression prevails that there is more risk of loss in transplanting evergreen trees than deciduous trees. This is undoubtedly true when trees of considerable size are taken. The very name indicates that these trees are always in full leaf.

Consequently there is an immediate draft upon the resources of the tree, after planting. It is essential, therefore, that there should be immediate root action, to supply this demand. It is then self-evident that the fall is not a favorable time for this work. Undoubtedly there are many instances where trees, with more or less earth, have been removed late in the fall, and have lived. But in our cold climate there is little or no root action from November until May, and hence the tax upon the tree late planted and exposed to the drying winds of winter and early spring is very great, and frequently fatal. There is a very general agreement among planters that early spring is also an objectionable time. The ground in March and April is usually wet and cold and the root action must necessarily be very sluggish and insufficient to supply the increasing demand from evaporation.

But in the month of May the ground has become warmer and all the organs of the tree are excited into activity. It has been found by uniform experience that a most suitable time for removal is just as the buds begin to swell and indications of returning life appear. There is sap enough stored in the tree to sustain it until the speedy action of the roots will continue the supply. Consequently the great bulk of this work is confined in our latitude to the month of May. It is unfortunate that this large work is confined within the narrow limit of this busy month. There is also a more serious objection that the inevitable check consequent upon removal occurs just at the time when the tree is coming into its active growth. It is, therefore, to be expected that this growth will be enfeebled and the appearance of the tree affected, for the first year. If a hot, dry spell occurs in June, the evaporation from the young growth is excessive and losses frequently occur. Still we must repeat that May is the month for removals. Is it the only month? For many years past I have advocated the month of August as a most suitable time. As an extensive experience has confirmed this opinion and as considerable adverse criticism has been advanced, I desire to state the case with some fulness, in the hope that, so far from misleading the public, I may help, by extending the time for doing this useful work, to contribute a real advantage in the adornment of our homes and of the landscape.

In the year 1871, I owned a nursery plantation of about forty thousand Spruces, Arbor Vitæs, Pines, and Hemlocks, of varying

sizes, from two to six feet in height. As I desired to convert the land on which they stood into an ice pond, I decided to remove the trees during the month of August, to a lot about half a mile distant. It was a large experiment, but I reasoned that the conifers make their growth by the first of July, and the rest of the season is spent in maturing the wood, so far as the tops are concerned. But the roots on the contrary are in a condition for active growth throughout the season, and especially so if placed in a new and mellow soil. The ground is warm in August, and when newly stirred is friable and in excellent condition to encourage quick root action. As the year's growth of wood is fairly well matured by the tenth of the month, the tax from evaporation is only moderate and this is met by the night dews and the moisture which usually occurs with the dog-days. Upon theory then the trees should easily sustain the shock of transplanting and speedily commence the formation of roots, which should have a firm hold in the soil before the ground freezes. The August and subsequent fall of my experiment proved to be exceptionally hot and dry; indeed so severe was the heat and drought that our late President, Joseph Breck, predicted a total failure. I hesitate to mention the facts as a precedent, yet it is true that in the face of a broiling August and early September sun, for week after week the trees were transferred, without the aid of any water or mulch to assist them. In November following, I had the pleasure of taking up several of the trees and showing to Mr. Breck the very abundant formation of new roots. The warm, floury condition of the soil was conducive to this growth. A wet fall would not have been as favorable. But the new lot was on a northern, exposed slope and the prophecy was that the winds of the following winter would ruin the trees. Any one who had seen the new roots would know that there was little danger of this result. The following summer showed as fine a field of newly planted trees as I have ever seen, with less than five per cent of loss, as I now recollect. The success was so complete, on so large a scale, and under what would be considered adverse circumstances, that I have ever since considered the question as settled. It has been my custom in subsequent years both to transplant myself, in August, and also to sell trees, as ordered, and the results so far as I know have been uniformly satisfactory. Indeed, I have removed at this season trees of larger size than I should care to take in May. And these

were trees which had stood so long without previous removal that a large percentage of loss should have been expected, yet it has been an agreeable surprise to me to find much less loss than I have ever had with such trees in May. Nor is this all. The growth of the following summer has uniformly been better than with trees planted in May. Pines, spruces, and other varieties stretch away as if they had not been stirred. In August, 1889, I planted a hundred Norway Spruces, which were about eight feet high, in a hedge-row and not one of them failed. At the same time I removed over three hundred *Picea pungens* and *Pseudotsuga* which were from two to four feet high and lost only one, and this one was evidently in feeble health when taken. Last August I transplanted about fifteen hundred *Picea pungens* and other kinds and they were as usual, without a single exception, so fresh looking in November, that I invited our Garden Committee to inspect them, with the purpose of showing the new roots, but the early freeze prevented the visit. I am confident that next summer's growth will show much more vigor than could possibly be expected if the trees had been planted in May. And I will allow any failures to stand in the lot until the first of August next, so that any one who desires can see what liability to winter-killing there may be. I do not anticipate any. Let it be distinctly understood that this is August and not fall planting — not later than September 15 — which I recommend.

But I hear it said that all this applies to removals for short distances and with special care and favorable weather. As to weather I have tried all sorts, from excessive wet to excessive dry, with uniform success, though a medium is of course the best. As to special care, this should always be given,— no more in August than in May. And in regard to distance, it is to be said that it is difficult to send large sizes long distances, at any season. They are liable to heat when packed in boxes and also to become exhausted by evaporation during the time required for transit and before the roots can become re-established. Hence it is always best to procure conifers of local growth, where this can be done, especially if they are to be of some size. Undoubtedly early spring is the best time for importing this stock from Europe, the liability of heating being less at this season. Care should be taken, however, not to plant until the ground becomes warm. But I have sent sizeable trees as far as Mount Desert, and various

other distances, in August, with excellent results. In the early part of September, 1889, I received a lot of wild seedlings picked up in the latter part of the previous August, from the high altitudes of the Rocky Mountains. From such wild stock, with growth more or less stunted, we expect, as a matter of course, that there will be much greater loss than from nursery-grown trees. Last August I inspected this stock, after it had been planted a year, and the following results were shown:

Out of 2,800 *Picea pungens* received, 2,330 were alive.

Out of 3,220 *Picea concolor* received, 2,389 were alive.

Out of 500 *Pseudotsuga Douglasii* received, 355 were alive.

I must also in candor mention another lot of 1,000 *P. pungens* of larger size, averaging about a foot and a half, received from another collector, and a good deal stunted, of which there has been a loss of a little over one-half. I do not, however, consider this last lot a fair example. It appears then that the loss on the first lot of *P. pungens* was about sixteen per cent and on the *concolor* and Douglas Fir, about twenty-five per cent. It has been my experience that these last mentioned two firs do not transplant as surely as the Spruce. It is my opinion that *Picea alba* taken from the pastures of Maine in May would not give better results than were shown by *P. pungens* which travelled twenty-five hundred miles in August.

An extensive experience covering a period of over twenty years leads me then to this general opinion that in cases where conifers can have quick transit it is safer to remove in August than in May. Especially is this true with large sized trees, like Spruces from eight to ten feet high, where distance does not forbid taking them in wagons. In all cases the growth of the first season after transplanting will show a marked contrast in favor of the August planted tree. If this opinion is sustained by the experience of others it will prove to be a most important advantage in extending the time of planting to more than double its usual narrow limits, and to a season when there is more leisure than in the hurry of spring time. This subject appears to me to be of such importance that I am willing to bear the brunt of sharp adverse criticism until the truth can be demonstrated.

Culture.— I will close with a few brief suggestions in reference to culture. It is wise to consider the habitat of each specimen and endeavor to supply similar conditions of soil and exposure, so

far as is in our power. Because a tree succumbs in a given case, it will not do to pronounce its variety unsuited to our climate. Forests of timber trees of the Hemlock flourish far to the north of us and yet the Hemlock is undoubtedly too tender for exposed positions in this vicinity. We should provide sheltering wind-breaks for plants of doubtful hardiness. On the other hand we would not naturally select a too warm and sunny position for such dubious Firs of the Rocky Mountains as *amabilis*, *nobilis*, and *grandis*. We should infer that they would receive too much winter excitement and that a protected, but cooler and perhaps northern slope would secure more nearly favoring conditions. It is obvious that the Pines will take the lighter soils; the Spruces, Firs, and Junipers choosing the intermediate, while the Retinosporas and Thujas will thrive in even a wet soil, though by no means preferring this condition. Though there are increasing evidences of the hardiness of the Sciadopitys, yet I have observed that in full exposure to the winter sun its foliage is liable to lose its fresh, green color and to become brown. Specimens looking north and shaded from the sun do not have this appearance. There can be no question that the rich and varied colors of some of the newer varieties depend in a considerable degree upon the nourishment received from the soil. You have observed the deep, luxuriant color of the Purple Beech under high culture, in contrast with the dull brown of the same tree in a poor soil. Similar results may be expected with conifers. It is an exploded idea that they will not endure enrichment. Fresh horse manure is undoubtedly too hot for the surface roots, if applied in quantity, but cooler composts will heighten colors to a surprising degree. Youthful vigor may also be thus restored to older trees. I have found that the silvery sheen of the *Picea pungens* may be greatly increased if removed from a heavy soil to a floury, well-enriched loam.

We are but beginning to appreciate how well-deserving of the highest cultivation are these enduring products of Nature. They are not limited to a brief glory of inflorescence; they are not confined even to an entire season. They are ever-verdant, furnishing a cool and varying shade in the heat of summer, and a sheltering warmth and cheerfulness, which can brighten and glorify even a winter landscape.

What a curious, strange, wise device, that these trees should have been so constructed that their leaves can endure the freezing

of generally two and in one case, at least, the *Pinus aristata*, of sixteen winters, without losing their vitality! And the form of the leaves is such as to offer as little resistance as is possible to the winds and the snows. Surely the wisdom and the goodness of the Creator are seen in this as in all His works. Conifers were created — not evolved.

Discussion.

Charles S. Harrison, of Franklin, Nebraska, said that in the west great interest is being awakened in conifers. There their cultivation is beset with serious difficulties. The air of the western plains registers only about 50° of moisture against 90° in the Atlantic States. For this reason many eastern evergreens fail entirely. There is no use in planting the White, Black, or Norway Spruce near the 100th meridian. He had spent hundreds of dollars in finding out what he could not do.

The *Pinus ponderosa* is a graceful, hardy, heroic tree. It does well anywhere west of the Missouri River. In form it resembles the Austrian Pine, but is of a deeper green and finer form. It has long glossy needles, and when in a thrifty condition is crowned with massive plumes, which render it very attractive. On his grounds, though the mercury averaged 100° in the shade for over two months and the American siroccos blew like a blast of death, and though the rainfall for the year was only seven inches, making it impossible for any water to reach the roots,— in spite of all this, these trees made a growth of a foot and more. They thrive in the foothills of the Rockies, where their roots may not be wet for years. If pressed too hard by the drought, they will drop two-thirds of their needles, and by thus taking in sail will live on. These trees which have been tested in the east have been from the dry, hot foothills. He thought that if brought from an altitude of nine thousand feet, where they lie much of the time under the snow, they could be made to succeed. The Douglas Spruce, he thought would be the most thrifty of all the evergreens. It is so in the eastern nurseries and on his own grounds. He saw it in the yard of D. Hill, of Dundee, where the ground was unfavorable, and it was by far the thriftiest tree on the place. B. E. Fernow, our Chief of the Forestry Division of the United States Department of Agriculture, says he saw on the western slope the greatest burden of timber on earth, of this tree. In the higher altitudes it often

puts on a silver type, and in the distance looks like *Picea pungens*. It has a wide diversity of form and foliage; some trees have short needles like the hemlock; others have needles of great length; some trees have a graceful, pendulous habit; others are more rigid. The deeper colors with silver tints will be very attractive. But from long observation Mr. Harrison believes that the *Abies concolor* will be the tree of the future. Henry Ross, Superintendent of Newton Cemetery, and Mr. Hunnewell have some fine specimens growing, but even from these one can hardly conceive of the beauty and attractiveness they present in their mountain home. While in old age both the *pungens* and the *Engelmanni* revert to the green and lose the silver, the *concolor* retains its unique beauty down to its death.

Mr. Harrison said he had seen massive trees half dead, with limbs yet alive, robed in all the beauty of youth. You can pick out a grove of these trees miles away, from their rich contrast with the neighboring green. He would like to show the meeting a grove in the fruiting season. Here is one tree of richest sheen — silver and sapphire — the new growth being soft green. On the under side of the limbs are deep purple blossoms. The cones are purple also and are massed in large numbers on the top of the tree. The next tree of the same rich color, strange to say, has cones and blossoms of light green. He had seen two bunches from the same stump, with this diversity of color. To add to the effect a gum exudes from the cone, clear as crystal, which sparkles in the sunlight. Now stand back and let the breeze and the light play upon the branches, and mingle all the rich colors, and you have a scene worth crossing a continent to behold. These trees are somewhat hard to transplant, though T. C. Thurlow and W. C. Strong have made about seventy-five per cent of trees direct from the mountains live.

Mr. Harrison spoke of the adaptability of the soil and climate of Massachusetts to the conifers. He wondered that there is so little attention paid to beautifying the home and the farm when such facilities were offered. It is a shame so many old farms are deserted, and a further shame that many now worked are almost as bleak and dreary as a western prairie, when a little effort would make them charming elysiums. In the west one has great difficulty in starting the evergreens, but where once established they are doing well. Last spring the speaker planted over fifty pounds

of Rocky Mountain seeds, and thought that if Job, out on the borders of the Arabian desert, had attempted to raise conifers from seed and succeeded, he would have added to his reputation for patience. In planting seeds of conifers in the west one must observe the conditions of nature. First, have a screen to shut out over half the light, and cover the seeds with fine sand; but that is not enough. Heat and damp both attack the crown of the delicate plants and therefore they must be defended as in the forests by moss or coarse leaf mould. The plants, growing up through this, are protected so that some beds are defended even against a raging sirocco of 110° in the shade.

Mr. Harrison thought that the best way to secure the finest colored trees would be to select them where they grow by thousands in the mountains. For instance, in raising *Picea pungens* from the seed, away from its native habitat, it does not average as well for color as those mountain grown. He spoke of the difficulty of having these trees, when shipped from the mountains, retain their color. This will sweat out in transit and the planter will often think he has been defrauded when the very choicest specimens have been sent. Rich ground and good cultivation will, however, in a year or so restore the color to more than its original beauty. He said also that there is otherwise a marked change for the better under cultivation,— the needles become much longer and the color much brighter. Of course the sheen is dimmed by winter weather, but is restored to its marvellous beauty in the growing season.

Regarding autumn planting,— if he lived east he would practice it, but not in the dry air of the west. He read Mr. Strong's article in "Garden and Forest" while in Nebraska, and dropping the paper went out and planted three hundred trees, most of which died. But he concluded to charge it to the climate rather than to Mr. Strong, for that gentleman certainly had had wonderful success, and his advice in the matter had been largely followed by nurserymen east, and as far west as the Missouri River. He said that the planting of evergreens is now receiving much attention on the plains and that the west would vie with the east in making our whole country beautiful in forest, lawn, and landscape.

Jackson Dawson held that evergreens could be transplanted at any time in the year if proper care is given to the trees. Twelve years ago Mr. Paul, of London, had an order to furnish several car-

loads of evergreens, and plant them in fair-grounds forty to fifty miles away. A car-load was dug up, packed, transported to the fair-grounds, and replanted. By such instalments the order was filled in May. Before the end of June all these trees had to be cleared from the fair-grounds; therefore the same process was repeated and the trees were replaced in Mr. Paul's nursery grounds, without the loss of a single one; indeed they made a fair growth that season. Mr. Dawson thought well of home-planting of evergreens in August, but he did not think it probable that a case of evergreens could be transported fifty to one hundred miles at that season and come out well. If they did not suffer from drying of the roots while out of the ground, a fungus would probably be developed which would destroy them. He believed the best time to plant them was when the buds are swelling, or after they have completed their term of growth. There are two sets of roots formed in each year; the first just after starting to grow in the spring; the other in the summer, after the short season of rest. If a seedling or small plant is potted in July it will throw out new roots in two weeks, which illustrates this law of the whole family. Mr. Dawson's first work, after his return from the war in 1864, was the removal of one thousand Arbor Vitæ trees, from six to twelve feet high, which had to be done between the second of June and the second or third of July. They are all healthy plants today. In 1885, three hundred and fifty white pine trees were procured in November in order to have them ready for use in the following spring. They were heeled in and covered with leaves, which kept them moist, and prevented heaving by frost. They were all planted out in the spring without loss. Not only conifers but all other evergreens are really easier to transplant because the roots are always in action, and loss from transplanting arises chiefly from the careless, hap-hazard manner in which the work is generally performed. *Pinus ponderosa* is a good tree in parts of the west, but it does not appear to succeed here. He started to grow pine and spruce seeds from western localities with good success. He planted out twelve or fourteen hundred seedlings of *P. ponderosa* from the collection, but they have gradually died out; a fungus attacked the bark, and eventually destroyed them. There is a tree in the Botanic Garden at Cambridge, grown from native Colorado seed, which is a good plant. *Pseudotsuga taxifolia* has sometimes been called *Pseudotsuga Douglasii*, and *Abies Douglasii;* when

brought from Colorado, it is hardy, but if seed is brought from California the plants prove too tender for this region. There is a very beautiful false hemlock — a new form of *Pseudotsuga taxifolia*, introduced by Robert Douglas, of Waukegan, Ill., which is a perfect weeping tree, and seems to be a most desirable acquisition. *Abies sub-alpina*, a species brought from Mount Shasta, is perfectly hardy, but is not a strong growing tree in Massachusetts. *Abies Engelmanni* is a promising but rather slow growing tree. It is more compact and more conical than *A. alba*, and a specimen in the Arnold Arboretum, now seventeen or more years old, has never shown sunburn or scald. *A. concolor* from Colorado and Utah stands our climate well and is one of our best evergreens — very beautiful and valuable. Mr. Dawson fears that *Picea pungens* will not realize all that was hoped for it, as a fungus has attacked the leaves of several trees; but they were growing upon rather poor soil, and the fungus may not become general under more favorable conditions.

Jacob W. Manning said that in 1872 ten Rocky Mountain evergreen conifers were added to his collection, including *Pinus flexilis*, *P. ponderosa*, *P. contorta*, *P. Murrayana*, *Abies Douglasii*, *A. pungens*, *Picea concolor*, and some others. J. T. Allan, of Omaha, then Secretary of the State Horticultural Society of Nebraska, collected in that season about 50,000 of these trees, in the Colorado spurs of the Rocky Mountains; and exhibited ten of them, in tubs, in Boston, in September of 1873, at one of the most successful meetings ever held by the American Pomological Society. These trees were presented to Mr. Manning by the owner at that time, and they were planted in the Reading nurseries. *Abies pungens*, *A. Douglasii*, and *Picea concolor* were successful, and were subsequently sent out to some customer who could not be identified afterwards. The speaker has ever since regretted their sale, as they were about the first trees of the kinds that were planted in New England. Mr. Manning next became interested in sixty-two *Abies pungens* which were growing in the Botanic Garden at Cambridge. It was in the year Professor Charles S. Sargent became Director there. The gardener in charge notified Mr. Manning, that autumn, that it was proposed to sell those trees, and he then thought one hundred dollars a fair valuation for the lot. At that time they had no reputation here for excellence in

any respect; therefore there was no demand for Rocky Mountain trees, but Professor Sargent said that if they were in England they would command a guinea apiece. Later on they were distributed to various points around Boston, some being sent to Forest Hills Cemetery and the Bussey Institution, and some planted in private grounds. They have served as object lessons in beauty of form, color, and character, and have created a desire and demand for specimen plants of those having the silvery green foliage. After it was well known that the beautiful evergreen trees of California would not succeed in New England, full twenty years elapsed before it was learned that the same species taken from their native forests in Colorado, or grown from seed brought from that region, were hardy in the East. While either trees, or seeds from trees, of the same varieties grown upon the Pacific coast ranges in California, uniformly failed here, both trees and seeds which were carried from California to England were grown successfully there, but if brought from thence to New England they just as uniformly failed. But those sixty-two trees before mentioned as doing well in the Botanic Garden in Cambridge, were raised in England, from seed grown in *Colorado*, and were imported into this country when quite small. This discovery, if not new, was an important factor in leading to the present demand for Rocky Mountain trees. Their number now in sight here can be counted by hundreds of thousands, in seed-bed stock and larger growth. Thus the Douglas Spruce, *concolor*, *pungens*, and *Engelmanni*, are becoming more and more common in nurseries, and desirable in collections of trees, and their names are found easier to speak.

F. L. Temple said that the most valuable sorts of new evergreen trees in this latitude, are those we get from the region of which Mr. Harrison had so eloquently spoken to us. Most of the conifers of Europe and Asia are already well known to us, and we know pretty well what can be expected of them here. We cannot expect much more of special value, from those sources, unless, it may be, in the way of new varieties of the species which we already have. He had cherished very great hopes of the future usefulness of the *Picea pungens* in this latitude, and had been enthusiastic in its propagation, but, while the blue form in the young trees is wonderfully beautiful, it appears to be a fact that none of the full grown trees, even in its native habitat, hold the full blue color so attractive in the younger trees. The plain,

green form of it is one of the least beautiful of all our conifers, and he had seen it used by the thousand in an English nursery, in trees from two to four feet high, to fill in roadways, as the green trees could not be sold there at any price.

He thought *Picea pungens*, in its blue forms, would always be used largely for ornamental planting, but it is well to know the truth, which seems to be that its duration, as a blue tree, is only for a period of, say thirty to forty years. He is more and more convinced, however, that we have, in *Abies concolor*, a tree of the very first rank as to permanent color and beauty, and which is destined to come into popular favor and be very largely planted to give a rich touch of unusual color to our masses of evergreen trees in ornamental plantations. Its great scarcity and high price are the only obstacles to its immediate use in large quantities, and a supply will soon be grown to meet the demand. The curious fact of this tree having the upper side of its foliage of the same beautiful, silvery blue as the under side, makes this superb silver fir the most strikingly effective tree, even to casual observers, of any species whatever now known to our gardens.

On the question of transplanting evergreens, Mr. Temple agreed pretty closely with Mr. Strong, although he believed that the larger portion of losses sustained in this work are due more to careless digging and packing, and lack of attention afterward, than to the supposed difficulties from planting at a wrong time of the year. Another serious fault in such changes is the inattention to proper selection of ground. Many trees set in moist ground live and thrive, which if on a high and dry place would surely die. In Mr. Temple's own grounds he has thousands of Balsam Fir and White Spruce trees, put in between September 20 and the middle of October, which with few exceptions rooted well.

Mr. Dawson did not fully agree with Mr. Temple in regard to evergreens from the old world. He considered *Abies Veitchii* as the very best we have so far as he had seen them. *A. Sachaliensis*, *A. brachyphylla*, *A. Cilicica*, *A. Mariesii*, and *A. Cephalonica*, he esteemed highly desirable. Of the pines he named *Pinus Koraiensis*, *P. monticola*, and *P. Peuce*, and of the firs, *Picea omorika*, *P. Ajanensis*, and *P. polita*, — all of a promising character. Evergreens may attain a good growth in a sand-bank, in from one hundred to two hundred years, but when we plant them for ornament the ground must be in the best condition in order to have them make their growth in our own day and generation.

Benjamin G. Smith asked what fertilizers are best to use for evergreens.

Mr. Dawson replied that any good manure can be used. Cow manure is preferable on high, dry land, — in fact anywhere except on low, wet places.

Edmund Hersey regarded the Hemlock as the most hardy and reliable, as well as the most beautiful evergreen tree we have. On his land he has no other tree of this family that will endure the extremes of our climate so well. He has them in positions exposed to the ocean blasts and the north and northwest winds, and they have sustained no injury during the last thirty years, while some of his Red Cedars, with the same exposure, and even in more sheltered places, have been winter-killed. The hemlock makes one of the most beautiful hedges, and it can be trimmed in a manner to make a thick, close hedge to the ground, leaving no open space even after a period of thirty years.

Mr. Dawson said there are no other evergreens in Massachusetts — perhaps in the world — so fine as the Hemlock and White Pine. The hemlock loves moisture, as from a brook at its foot, but not to stand in decidedly wet land. It will thrive if it has an eastern, northeastern, or even north or northwestern exposure, better than with a south or southwestern aspect. He considered both as among our most noble and valuable trees.

Mr. Manning agreed with Mr. Dawson and Mr. Hersey as to the hardiness of the hemlock. He referred to a certain slope or steep hillside, in the Arnold Arboretum, at West Roxbury, which is well covered with a grove of fine specimens; also to the shore of Lake Kenoza, upon the grounds of the late Dr. James R. Nichols, at Haverhill, and the east shore of Spot Pond in Medford and Stoneham. One of the noblest specimens of this tree known to him, is still growing in the west part of Wilmington; it is five feet in diameter, eighty feet high, and spreads its branches over a diameter of sixty feet. The hemlock prefers a cool, damp soil, but grows well on any deep soil in his own grounds, even where the winds have ample sweep. In transplanting the hemlock or any other species of conifer, drying between the digging up and replanting should not be allowed. According to his knowledge and experience the best thirty days in the whole year for moving any conifers, in this latitude, are from April 20 to May 20. He has long been known as an "evergreen" man, and has practised close pruning of hedges and single specimens, but he is convinced

that a better hedge and a far more lasting one can be secured by a general shortening-in of the shoots, from the top to the bottom of the hedge, than by close shaving to a line, and the same principle will apply to belts specimen trees. Contracting the growth of these hemlocks may be very well where room is lacking to allow of more natural growth and expansion of the trees, but otherwise their health and beauty are promoted by more liberal treatment.

E. H. Hitchings spoke of riding from Dedham to Boston, over the Dedham Branch Railroad some fifty years ago, when he heard a fellow passenger call attention to a group of evergreens, saying that they always gave him pain, for they reminded him of the Stoics, as they appeared so utterly indifferent to storms and all other surrounding circumstances. Mr. Hitchings, on the contrary, appreciated their many excellent qualities and enjoyed them exceedingly. He mentioned a fine, double stemmed hemlock standing in West Dedham, which, for its beauty and noble appearance, was worth a walk out there to see.

Mr. Dawson alluded to Mr. Manning's remarks on Hemlocks for hedges, and asked his views concerning the Arbor Vitæ and other evergreens for that purpose, and their treatment.

Mr. Manning said that among all our trees there is no other so well adapted to use for a common hedge plant as the American Arbor Vitæ. It is one of our hardiest plants if well grown in soil suitable for cultivation; it can be dug up, and transplanted with great ease, and will endure more hardship than almost any other coniferous tree. If breaks occur in a hedge of it, even if twelve feet high, the places can be filled in with trees of the same size from the nursery rows and will soon be restored. He had two thousand arbor vitæs, from five to eight feet high, which stood thickly in nursery rows, and were transplanted to form a hedge along a driveway upon his grounds, and only five of them died. This hedge was pruned for eight years; then three hundred feet of it, making two carloads, was removed to Centre Harbor, N. H., and planted. Now, in 1891, it is one of the best hedges in New Hampshire. In another case two hundred and fifty feet of arbor vitæ hedge, eight feet high, which had been set from eight to twelve years, was taken up, carried from Reading to Lynn, and planted there in May, 1890, and nearly every tree of it is alive today. In the years 1872 and 1883 — eleven years apart — evergreen trees, and notably hedges, were sufferers from winter-killing to a remarkable extent. But the dead trees were mostly

found where the soil was very thin, over gravel, or a ledge, or where they were back of a bank-wall — that is above it — all being least supplied with the moisture necessary, but few died which stood in deep, moist soil. That most hardy native tree, so widely spread over our country, the Red Cedar (*Juniperus Virginiana*), also dies more numerously when in dry, rocky situations. In the latter fatal year, 1883, many of our native forest trees died — large white pines, oaks, etc. This disastrous effect was in each case caused by the prolonged summer and autumn drought of the preceding year, followed by an open winter, with little rain, not much snow, many periods of intense cold, and frequent extreme cold winds occurring during the winter and early spring, and therefore very deep freezing of the ground. These influences greatly weakened the vital force of all trees, as well as other vegetation, before the winter set in, and the unusual winter weather overtaxed the life force and produced the fatal results recorded. After the winter-killing of 1872, some writers declared that the arbor vitæ was not a fit plant to use for hedges in dry or open situations; that its native habitat was damp, shady forests. It is found in damp, even swampy, places, but it is also found near by, growing on the dryest rocky upland, from seeds sown by Nature, which have been wafted by the wind to points perhaps many rods from the trees on which they grew. In fact, we have no other tree, either native or foreign, adapted to so great a range of soils and other conditions as the American arbor vitæ, nor one that will endure more neglect or abuse. In connection with the statement of the winter-killing of evergreen and other trees in 1872 and 1883, it should be added that no trees were killed in places where the early snows fell and remained on the ground through the winter.

Mr. Dawson said he believed it was one duty of the Society to instruct the people in horticultural knowledge, and the object of his questions put to Mr. Manning was to draw out from him some of the facts relating to the choice of hedge plants and the necessity of a proper selection and preparation of the ground before planting the hedge, in order to ensure the permanence of benefits for which one does the work. He was pleased with the replies to his questions, and hoped they would prove valuable to those present.

Mr. Temple believed that the reason why the Arbor Vitæ is used so much is its cheapness, its easy transplanting, and its beautiful appearance when grown in a deep, moist soil. He considered it

the least valuable of all the evergreen trees in New England. The Red Cedar will flourish in light soils. The White Pine is desirable when it can be allowed to grow naturally. The White Spruce in many cases is most beautiful, especially at from ten to fifteen feet in height.

Mr. Manning esteemed the White Pine as beautiful as any of our evergreens. He did not approve of the close pruning to which many subject it, but said he had a belt of these trees, planted in 1869, which had been "shortened-in" each year, about the tenth of June, when the new growth is tender and easily broken with the fingers. Buds soon start out just back of the break and thicken up the outline beautifully. No other tree shows so complete a leaf-surface as this pine when pruned in this way, whether a hedge, belt, or single tree. Of other species, the Norway Spruce has been a universal benefactor, although an imported tree. Fifty years ago it was almost unknown here. The White Spruce is a native of our northern forests, from Nova Scotia to the Black Hills. Thirty-five years ago it was scarcely recognized by our American planters. It is specially adapted for use on the sea-shore, and may be seen close down to the rocky shores along the coast of Maine. The Red Pine is a native of New England. The Scotch and Austrian Pines are foreign trees but are desirable. All these can be shortened-in when the new growth is succulent. The Retinosporas are rich in foliage as evergreen trees, but to show to best advantage they require shortening-in, or they will disclose the dead inner leaves.

Benjamin G. Smith spoke of a plantation of evergreens in his grounds made forty years ago. It included White Pines, Scotch Pines, Hemlocks, Norway Spruces, and others. The white pines and hemlocks are still flourishing, and have attained the altitude of from forty-five to sixty feet. The Scotch pines and Norway spruces have nearly all failed.

The reading of the essay engaged the attention of the audience, by whom it was highly appreciated, and a vote of thanks to Mr. Strong for his interesting and valuable lecture was unanimously passed.

The President announced that on the next Saturday a paper on "Roses," by John N. May, of Summit, N. J., one of the most extensive and most successful growers of that flower, would be read by the author.

BUSINESS MEETING.

SATURDAY, January 24, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

No business being brought before the meeting it

Adjourned to Saturday, January 31.

MEETING FOR DISCUSSION.

ROSES.

By JOHN N. MAY, Summit, N. J.

Having been requested by your Committee to read a paper on this subject, I have in the following pages endeavored to say enough at any rate to open a discussion whereby I trust to learn more than I can ever hope to teach by anything that I can say. This subject has been so well and ably presented to this body so many times before, by men much better informed and more able to present it to you intelligently than myself, that I feel that I am almost an intruder here, and would certainly much rather be a listener than a talker on the subject; however, I will give my experience with the Rose, and trust you will be lenient with your criticisms.

The word Roses conveys to the rosarian a volume. It opens an immense field for discussion. The subject of raising new varieties alone, could be made most interesting if handled as it deserves to be, but at this time I fear that it would hardly be in place, neither do I think that I could under any circumstances do justice to this branch, though I certainly hope in the very near future to see American seedlings rank with the finest productions of the world, as we have every advantage for producing them,—summers that will ripen the seeds as well as any other in the world if not better; varied soils and climates, suitable for all classes of this large family, and lastly an appreciative public ever ready to admire and to buy them.

This, the queen of all flowers, has always reigned supreme for me, and will till the end of time. My first experience with the rose dates from the time I was eight and a half years old, when I

borrowed (without permission) three eyes of Souvenir de la Malmaison, then a new rose. I am sorry to have to confess it at this late day, but a clear confession, it is said, is good for the soul; anyway, having watched an elder brother doing considerable budding, and wishing to try my hand at it, I borrowed, as above stated, three eyes from my father's garden and took them to a neighboring hedge, where I found a wild rose on which I budded them. One of them grew and the next season produced three fine flowers, and from that day on, the rose (and this variety in particular) has always held a charm for me.

During all these years I have seen many, very many, changes in them, though some of the varieties that were then in their glory have not yet been eclipsed and still retain their places in the front rank. Among these are General Jacqueminot, Géant des Batailles, and many others too numerous to mention here. Among the Tea roses, Niphetos, Lamarque, Gloire de Dijon, and others still rank as first favorites; the same may be said of all the other branches of this family. But no one can gainsay that many great improvements in the family have been introduced within the last ten or twenty years; take, for instance, the magnificent Ulrich Brünner, Mrs. John Laing, Earl of Dufferin, T. W. Girdlestone, and many others of the same family. Among the Teas, the most graceful of all, combining, as this class does, elegance of form, beautiful color, and fragrance, stand preëminently Catherine Mermet and her offspring, The Bride, the latter today recognized all over the civilized world as the finest white Tea rose in cultivation; and of this year's introduction, the glorious Waban now before you, and its mother and sister grown and produced at the celebrated Waban Conservatories here in your own State. These clearly demonstrate the fact that the cultivation of the rose has wonderfully advanced within the last decade.

It may not be out of place at this time to give a few remarks on the cultivation of the rose here. Twenty years ago the principal roses grown for our markets were Bon Silène, Safrano, Lamarque, and a few others of like character. The only roses of any size then grown were Maréchal Niel and Cornelia Cook; today they are almost entirely supplanted by much superior varieties, such as you now see before you, and many others of a like size and beauty. To attain this end considerable skill has been brought to bear on their cultivation. Twenty years ago possibly five thou-

sand roses per day was the limit of the supply for New York City; now as many as fifty thousand per day can often be found there, and, according to my own estimate, based on the most careful calculation, I think I am quite within the limit in saying that it often reaches, in the spring of the year, nearly one hundred thousand per day, which speaks volumes for the growth, advancement, refinement in taste, and development of horticulture. To meet the demands of the public many changes in the cultivation have been brought about; where from the old system one rose was cut, ten at the present time are cut from the same space. Perhaps you will ask how this has been brought about; my answer is, largely by superior cultivation. Formerly they were all grown on the solid bed of the greenhouse; now they are grown on raised benches, beds, etc., and with the greatly improved style of greenhouses now at their command, growers are enabled to produce large quantities with little expense compared to that formerly involved.

When I began cultivating roses under this system many growers predicted failure; today ninety per cent of the florists in this country are growing their roses on this principle, with, of course, some modifications which experience has taught. It was formerly the practice to plant a house of Tea roses and grow them on for years till they actually died from overwork; now the general practice is to replant fine, healthy, new stock every year, or, at most, every two years. Originally the prevailing idea was that the roses must have a deep, rich border ranging from twelve to twenty-four inches in depth to produce good roses; now the finest roses in the country are produced on benches, etc., with from two and a half to four inches of soil. To keep plants in such a shallow bench constantly bearing they must, of course, have liberal treatment. After they are planted, say in July, and get fairly started into growth, they need a mulching of the best manure they can have. This induces surface root action, and these roots should never be disturbed. In the course of eight or ten weeks the plants will have absorbed the coat of mulching. Our practice is to give then a light dressing of pure, fine, ground bone, covering it with another thin coat of manure. This is feeding the plants where it will do the most good and, at the same time keep their roots where they get all the benefit of the fresh air circulating through the house. This process is repeated as often as required, and where

the plants are growing very strongly the application of other stimulants, such as liquid manure, nitrate of soda, etc., is of great benefit to them, provided, of course, that due care is used in their application. To apply such strong stimulants injudiciously, simply means ruin not only to the flowers but to the plants also. I do not hesitate to say that more plants have been killed by overfeeding than by all other causes put together. One thing should always be borne in mind in reference to plant life, and that is that it is almost identical with animal life so far as their requirements go. To maintain a plant in health and vigor requires careful and judicious feeding, just as an animal does, and the harder it works the more care it requires. Those who treat their plants or animals otherwise than reasonably will pay dearly for their pains, and reap the harvest for which they have sown.

Possibly some may doubt the soundness of such a doctrine and say, as many have said to me, "How can you reconcile this statement with our practice of growing roses in the open ground, where we use immense quantities of manure, and the more we use the better our roses grow and bloom?" Very true, they do, but the conditions are so totally different that there can be no comparison whatever. In the open ground, the action of the air, the wonderful power of absorption by the soil of unlimited depth, rains, dews by night, and sun by day, all tend to produce such a vast difference from the conditions of a greenhouse where every drop of water or particle of manure has to be brought into direct contact with the roots of the plants, that it would seem almost an absurdity to make any comparison whatever.

For the successful cultivation of the rose under glass there are a few simple rules to follow: first, to procure a suitable soil, which should be, if possible, fresh sod from an old pasture; that having plenty of grass root fibre in it is generally the best. If very heavy the addition of a liberal proportion of sharp sand will improve it, but if of a very light, sandy character the addition of some soil of a clayey nature will be beneficial for most roses. When carting together in the spring mix one part of good, clean cow manure to six, eight, or ten of soil, according to the quality of the soil. Turn it over two or three times and it is ready to put into the rose house.

The next thing is good, strong, clean and healthy plants, for without such no one need expect the best results; and the next is

to keep the house, after the roses are planted, in good condition as long as they are in it, which means all the year round. This is more important than many suppose, as no plant can reasonably be expected to thrive where dirt, mud, and decaying vegetable matter are allowed to lie unmolested for weeks or months together.

Lastly, we come to the watering and general care of the plants. On the subject of watering there is a wide diversity of opinion, mainly brought about by the different conditions of soil. The only safe guide is a careful study of the nature of the soil one has to deal with, using water in proportion to its requirements. As a general rule, a rose in full growth should never be allowed to become dust dry, neither should the soil be flooded with water till it becomes almost of the nature of mud, but for nearly all soils it is better to water the plants immediately when the soil shows the least indication of getting solid or turning slightly light in color.

For the general care and management I am afraid I should tire you all out if I even attempted to describe it in detail, but even if I did not do that I think it entirely unnecessary here—as much so as it would be for a stranger to go to Rome and tell the Romans what to do; but in conclusion permit me to say that although I firmly believe that in the past twenty years greater strides have been made in the cultivation of the rose than was ever done in double that time previously, yet I certainly think that much greater advancement will be made in the next ten years than has been done in the past twenty. Evidence of this is very clear to any one visiting the different parts of this country, and I trust that after we have all passed away the "Queen of Flowers" will still have as great a charm for our successors as she has for us. Long may she reign supreme, and this hospitable city remain the seat of her throne, to which pilgrims will ever come from all over this broad land to do homage to her majesty in all her golden glory!

Discussion.

Michael H. Norton asked whether Mr. May found a ready sale for his roses, and for what class. There is no difficulty here in selling first-class roses.

Mr. May replied that there is no difficulty in disposing of such roses as those on the table, though you cannot always get the best prices for them. There is no question that roses and other flowers

are a luxury which cannot be afforded by all. He had seen 37,000 roses of first quality in the market at nine o'clock, and at eleven o'clock only 3,000 of them were left. A year ago roses brought from fifteen to twenty-five dollars per hundred, and this year not much more than one-half as much. When the market is overstocked, the second quality have to be sold to street fakirs, and some one gets the advantage. For his part, said the speaker, he would never see a flower consigned to the ash barrel, but would rather have surplus flowers sent to the hospitals, etc. He would like to have ways and means by which growers could dispose of their surplus stock profitably; one way to prevent an overstock is to grow better flowers. Nothing injures the flower market more than to have a lady buy flowers from twenty-four to forty-eight hours old, and which fall to pieces soon after she gets them home.

Patrick Norton said that Boston people like good roses, and send the second quality to New York. He thought there was no place in the country where so many flower stores and flowers could be seen in the same space as in Tremont street. He inquired of Mr. May what are the most profitable varieties of roses and suggested the names of Ma Capucine and Mme. de Watteville.

Mr. May said there is no room in New York for poor roses. Which are most profitable depends very much on who raises them. Ma Capucine is one of the most lovely, and brings in the most money by twenty-five per cent. They have been a little disappointed in getting the Waban in New York; it has not been shown to the public in that city, though they have it in Orange, N. J., and the ladies admired it very much. Florists from New York who saw it in its home were very favorably impressed with it.

President Spooner suggested that information was desired upon the best selection of Hybrid Perpetual roses for forcing — such as Ulrich Brünner — and asked Mr. May's views upon that department of the business.

Mr. May said that the New York market is a ticklish place. General Jacqueminot was most popular for several years, and then ladies took a notion to yellow roses, and when the tide turned again in favor of red roses, a neighbor of his who had hung on to his old favorite (Jacqueminot) was the only one who had red roses. Ulrich Brünner has always been in demand in New York, but not quite so much this year as in previous years. One

grower, who had a fine house, found some difficulty in selling them. From the middle of January onward there is no difficulty in selling really fine specimens of this variety, but they must have stems two or three feet long and the flowers must be four or five inches in diameter. Mrs. John Laing is one of the most popular roses in New York; it is fragrant and sure blooming, but cannot be forced for Christmas without having a considerable portion of the crop come deformed and short stemmed.

Patrick Norton said that the Ulrich Brünner rose finds a good market in Boston.

President Spooner said that the Ulrich Brünner is fine in the garden.

William C. Strong inquired how benches answered for forcing hardy roses. His experience had been with them planted in solid beds, two, three, or four years, and he doubted whether it would pay to plant every year.

Mr. May said that the trouble comes here: if ladies get a fair rose today they want one earlier next year, and these roses cannot be forced early in a solid bed, though for March blooming it will do, and they will last for years. He had seen a greenhouse eighteen feet wide and two hundred and ten feet long, filled with General Jacqueminots planted eight or nine years, where 237 buds were counted in a space two feet square, and 37,300 buds were cut from that house as one crop.

William J. Stewart inquired what Mr. May's experience had been in the introduction of new roses.

Mr. May said that twenty-five years ago he was growing roses in England, and they used then to get their new varieties mostly from France. One autumn he went over to France and visited M. Pernet, one of the great rose growers, who showed him several new varieties to be sent to England, and some others, inferior to them, which were thought good enough for the American market. Two years ago he paid a French grower five hundred and thirty dollars for new roses, at five dollars per plant, and they all went on to the rubbish heap in six months. Once in a while we strike such a gem as Catherine Mermet, the finest of all Tea roses, but ninety-nine per cent of what we import are useless for our purpose in this country.

President Spooner inquired of Mr. May as to the value of Magna Charta as a rose for forcing in New York, and what are better.

Mr. May replied that two roses, Anna Alexieff and Heinrich Schultheis, are better, and that the former although almost as old as himself is still, as grown around New York, most prolific for early forcing. Heinrich Schultheis is one of the finest of all for this purpose, though discarded in France and England. It is every way superior to Magna Charta, which goes off in color when forced and has failed to come early. Mr. Asmus, one of the best New York growers, has failed with Magna Charta for very early, but has fine ones coming on now.

President Spooner said that Heinrich Schultheis is very fine in the garden. Anna Alexieff is not so good in the garden, being too short-petalled; its only merit is its earliness.

Patrick Norton asked Mr. May what Tea rose he considered most profitable.

Mr. May said that of Tea roses without any admixture, The Bride is unquestionably the best. Of hybrid Teas, the Duchess of Albany is best; it is of magnificent color, clean all the way through, and fragrant. If too much heat is given, it becomes purple.

John G. Barker had hoped for a paper on the rose as a bedder: he was more and more impressed with the view that we can make our gardens more beautiful with more flowering and fewer foliage plants. He had a bed last season planted with La France roses, surrounded with Hermosas and Aggrippinas; it was not as satisfactory as he hoped, but the field is still open.

President Spooner mentioned among the newer roses Gloire de Margottin, of dazzling red color, and Gloire de Lyonnaise, of lemon color, but a Hybrid Tea rather than a Remontant. He then asked Mr. May how they ranked for forcing.

Mr. May said that he felt much enthusiasm over the Gloire de Margottin when first sent out; it is of a most glorious color. As regards forcing, he was rather disappointed with it. It has a weak stem but is one of the finest for summer bedding. All like the color. Gloire de Lyonnaise was a disappointment to him.

Mr. Barker asked Mr. May if he would recommend planting La France on its own roots, or would prefer budded or grafted plants.

Mr. May replied that he is a great advocate of roses on their own roots. If a plant of La France on its own roots is killed down it will sprout again from the root, but you cannot get so

large a plant the first year as if grafted. If a lady sets out a dozen plants on their own roots she will have good bushes a dozen years hence, but if she sets out grafted plants she will have in two years a lot of Manetti stocks. A neighbor of the speaker planted thirteen years ago twenty-five La France on their own roots; they are now six feet high, and last July he cut two hundred flowers from them. The great difficulty we find with much the larger portion of the public is that they do not understand the difference between the suckers from the Manetti stocks and shoots from the graft; hence it is much better to give them plants that will not be ruined by suckers.

Frederick L. Harris said that if we import roses budded low down and plant them deep, they will stand our climate well and in one year give more flowers than plants on their own roots will give in two years. Once in a while we get suckers from the stock, but anyone who studies the character of the shoots can remove them. The speaker would not recommend purchasers to buy any roses budded on stems five or six inches high.

President Spooner said that he is a strong advocate for budded roses, if they are budded in the right place and properly grown. They should be planted so as to have the stock three or four inches beneath the surface, and the bark should be raised a little on each side to enable them to emit roots more readily; you will then get a better plant in one year than in three or four years if they are on their own roots. The Manetti stock is the best for light soils; the brier sends up too many suckers. All the best roses that come to our shows are from budded stocks. He does not want to wait four or five years to get a strong plant.

Among the best summer roses are La France, and, for later, Fisher Holmes or Prince Arthur (the last named a seedling from General Jacqueminot), Heinrich Schultheis, and Lady Helen Stewart. For white, Merveille de Lyon and Mabel Morrison. Gloire de Lyonnaise throws up fine shoots. Madame Victor Verdier is a grand garden rose. Alfred Colomb is of globular form and high-scented. Mme. Isaac Pereire, a Hybrid Bourbon, is a good climbing variety. Earl Dufferin has a full flower and is destined to be one of the best. Marshal P. Wilder is too much like Alfred Colomb. Mme. Montet is a free flowering variety and of very fine color. Mme. Gabriel Luizet is very desirable for this purpose. Mrs. John Laing is almost as free flowering as General Jacqueminot.

Mrs. H. L. T. Wolcott asked the president if when budded plants are set out as recommended by him, you do not virtually have a plant on its own roots after a year or two, to which he answered, "yes." Mrs. Wolcott went on to say that a good while ago she planted budded roses under the direction of the late Hermann Grundel, who advised her to lay them down so that they would root from the grafts, and she saw them twenty years afterwards, and never saw better bushes or a better show of flowers.

John S. Martin said that when he wished for bedding roses many years ago, he asked Ex-President C. M. Hovey, as to the relative value of those on their own roots, and those budded on a stronger stock. His answer was: "Never buy budded roses to plant in the garden," and Mr. Martin now thought that was the better rule.

Patrick Norton said that while La France is considered a good rose, the Duchess of Albany is higher colored, and he advised those present to recommend to their friends to give it a trial for outside cultivation.

On motion of William C. Strong a vote of thanks to Mr. May for his instructive and valuable lecture was unanimously passed.

O. B. Hadwen, Chairman of the Committee on Discussion announced for the next Saturday, a paper upon "Insects and Fungi Injuring Our Fruits, and Remedies Considered," to be read by the author, Samuel T. Maynard, Professor of Horticulture at the Massachusetts Agricultural College, Amherst.

BUSINESS MEETING.

SATURDAY, January 31, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

E. H. Hitchings moved that a committee of three be appointed by the Chair to nominate a Committee on Window Gardening, of seven members. The motion was carried, and the Chair appointed, as the Nominating Committee, Nathaniel T. Kidder, Arthur H. Fewkes, and Joseph H. Woodford.

Adjourned to Saturday, February 7, 1891.

MEETING FOR DISCUSSION.

INSECTS AND FUNGI INJURING OUR FRUITS, WITH REMEDIES CONSIDERED.

By SAMUEL T. MAYNARD, Professor of Botany and Horticulture in the Massachusetts Agricultural College, Amherst.

At this season of the year fruit growers, market gardeners, and farmers are making their plans for the work of the coming season, and in their estimate of the income they hope to derive from their crops, they reason, perhaps, something like this: One has one hundred apple trees or one thousand grape vines, and if the apple trees are twenty years old they should yield at least three barrels per tree, or the vines, if five years old or more, should yield ten pounds per vine, or a total of ten thousand pounds, and reckoning the prices at the average for a decade he gets upon paper very satisfactory returns.

But how many of us make our plans for the coming year with any degree of certainty that the results will give us even a fair return for labor and interest on the capital invested? We know too well from bitter experience the chances the crops must run with frosts, with storm and wind, with drought and wet, and above all with insects and the many blights, rusts, mildews, rots, and smuts, that feed upon and destroy the plants we cultivate.

We have the authority of the Entomological Bureau of the United States Department of Agriculture, for the statement that the loss by insect depredations to the farming interests, including all its branches, for the past year amounts to four hundred millions of dollars. This almost inconceivable amount of money from the destruction of our crops in one year! Yet who that has experienced the loss of his grape crop by mildew or rot, his apples by the scab, his pears by the scab and blight, his plums by the black wart and rotting of the fruit, his cherries and peaches by rotting of the fruit, his strawberries by the leaf blight, his potatoes by the potato rot, his oats and grasses by the rust, his cabbage crop by the club root, his celery by the leaf blight, his lettuce by the mildew, and his cuttings and plants under glass by damping off, will doubt that our losses are often as great from parasitic or fungous plant growths as from insects, if not greater!

It is seldom that we get a crop of any kind without a valiant fight for it. Fortunately we have learned to feel that we are greater than the foes that assail us, and that with each new insect

or fungous pest soon comes a remedy with which we may protect ourselves if we will.

When the Colorado potato beetle first made its appearance among us we thought we must give up this important crop, but now we find that by proper vigilance the crop can be successfully and profitably grown. So when we are almost discouraged in our attempts to grow fruit or other farm or garden crops, relief seems near us and we feel sure that we shall be able to combat all foes.

It is to the consideration of some of the most injurious insect and fungous enemies and their destruction that I invite your attention this morning.

In the growth of the apple we have to contend with the Codling Moth (*Carpocapsa pomonella*), the Canker Worm (*Anisopteryx vernata*), the Tent Caterpillar (*Clisiocampa Americana*), the Apple Maggot (*Tripeta pomonella*), and the Plum Curculio (*Conotrachelus nenuphar*) among the insects, and the Apple Scab (*Fusicladium dendriticum*), which also produces the Leaf Blight, among the fungi.

With the pear we must contend with the Codling Moth, the Plum Curculio, and the pear tree Psylla (*Psylla pyri*) among the insects, and the pear leaf blights (*Entomosporum maculatum* and *Fusicladium pyrini*), and the so-called Fire Blight (*Micrococcus amylovorus*).

The plum is attacked by the Plum Curculio — about the only insect seriously injurious to it — and the Plum Wart or Black Knot (*Plowrightia morbosa*), the Leaf Blight (*Puccinia prunispinosæ*), and the Brown Rot of the fruit (*Monilia fractigenea*).

The peach is injured by the Borer (*Ægeria exitiosa*), the Plum Curculio, and the Brown Rot of the fruit.

With the cherry the Plum Curculio is very injurious and the Rose-bug (*Macrodactylis subspinosa*) sometimes destroys the leaves.

The grape perhaps has the greatest number of fungous foes, and among the most injurious are the Powdery Mildew (*Peronospora viticola*), which is also the cause of the Brown Rot; the Black Rot (*Læstedia Bidwillii*) and the Rose-bug and Phylloxera (*Phylloxera vastatrix*) among insects.

The strawberry is injured by the Leaf Blight (*Sphœrella fragariæ*) and the Crown Borer (*Tyloderma fragariæ*).

For the destruction of the larger number of this great host we have two remedies, the arsenites for the insects and copper salt in solution for the fungi.

Perhaps we can best get at the most approved methods of using them by considering the enemies of each fruit by themselves.

THE APPLE.—The codling moth lays its eggs in the blossom end of the apple soon after the petals fall and continues to lay them for a period of perhaps two weeks or more. In some seasons and in some sections a second brood of eggs is laid by the perfected insects from the first brood.

The tent caterpillar and the canker-worm feed upon the foliage, beginning to work as soon as the leaves unfold, while the plum curculio feeds upon the foliage and perhaps the fruit, laying its eggs in the crescent shaped cut it makes in the skin.

These pests may all be destroyed by the use of the arsenites—Paris green, London purple, and white arsenic. To destroy the tent caterpillar and the canker worm we must make the application just as soon as the leaves unfold, and for the codling moth and the curculio as soon as the petals drop.

These applications must be made at intervals of from one week to twenty days, according to the weather. If there should be no rain after the first application for the tent caterpillar and canker-worm, another application will not probably be needed until the one made to destroy the plum curculio and the codling moth; then the applications should be made at intervals of from ten to fifteen days, up to the first of July.

During this time we must also be combatting the fungous growths, which under favorable conditions may begin work very early in the season. The apple scab is a minute plant that grows upon the surface of the apple leaf and fruit, and, while not penetrating the tissues very deeply, stops the growth at the point attacked and we have distorted or gnarly apples resulting from its early attack; or scabby, spotted apples when it appears later in the season. Its effect upon the leaf is, if in large numbers, to destroy its functions and it soon falls, or if only a few are found on a leaf it simply looks a little yellow and the whole tree has an unhealthy appearance.

This fungous growth, like most other parasites attacking our fruits, develops under conditions of warmth and moisture. The spores or seeds, which are produced in large numbers, are so minute that they may be carried long distances by slight movements of the air, and coming in contact with their host plant, the apple, under favorable conditions they grow very quickly.

In a cool dry season, there is very little development of rusts, blights, and scabs, so destructive in a moist warm one. For the past two years fungi of all kinds have developed in large numbers, and many kinds of plants have been seriously if not permanently injured by their attacks.

The past season the apple scab was so abundant that many trees which blossomed and set a large crop of fruit were so injured by it, that they could not perfect their crop. Upon a large tree in front of the house I occupy, so much of the scab appeared that the leaves were dropping nearly all summer and the lawn had to be raked several times to get rid of the litter.

To destroy this parasite, solutions of copper have been found effectual, either in the form of the Bordeaux mixture, ammoniacal carbonate of copper, or simple carbonate of copper solutions.*

While alone the ammoniacal carbonate of copper has proved the most effectual, unfortunately it cannot be used with Paris green or other arsenites, and if we wish to reduce the cost of the remedy for both insect and fungous pests to the lowest figures — and all know how little margin for profit there is even when we do not have this difficulty to contend with — we must combine the two remedies and apply them at one operation. With the Bordeaux mixture and the simple carbonate of copper solution we can do this, and without danger of injury to the foliage.

It has been found by experiments made at several of the state stations that Paris green and copper solutions can be used with lime mixtures at the rate of from 1 lb. to 100 gallons of the mixture, to 1 lb. to 50 gallons, without injury, some even claiming as concentrated a mixture as 1 lb. to 25 gallons. We also know that neither Paris green nor sulphate of copper solutions can be safely used upon the foliage of our fruit trees, in the degree of concentration required to destroy the above mentioned foes, without serious injury to the foliage.

I am confident that the reason why the use of Paris green has been so unsuccessful in many cases for the destruction of insect life, is that we have been unable to use it in a form concentrated enough to reach all parts of the plants without injury. This will also apply, in a measure, to the fungicides.

For the purpose of destroying both insect and fungous pests we must make an application of the simple solution of sulphate of

*See formulæ, page 65.

copper, called by the French *eau celeste*, to the twigs and branches before the leaves appear, to destroy any germs of the scab that may be lodged in the crevices of the bark; then as soon as the leaves have unfolded the lime and Paris green mixture must be applied for the tent caterpillar and the canker-worm, and as soon as the petals have fallen the second application should be made for the codling moth and plum curculio. This application must be repeated at the proper intervals — of one week to twenty days — according to the weather, until the first of July. After this, the Paris green not being needed, the ammoniacal carbonate of copper may be used. The latter application is to be preferred from the fact that it does not disfigure the fruit, while if the Bordeaux mixture is used late in the season, it adheres to the fruit so as to injure its sale unless washed. No substance has been found that can be used in this way and at the same time for the apple maggot, a little insect that in many localities and upon some varieties, is doing more injury even than the codling moth. The destruction of the fruit before the maggot escapes is the only remedy yet suggested that promises to be of any value.

THE PEAR.—The insects attacking the pear that can be destroyed by the arsenites are the codling moth and the plum curculio, and the fungi that can be killed by copper solutions are the pear leaf blight (*Micrococcus amylovorous*, Burrill), and the pear scab (*Fusicladium pyrinum*). The pear leaf blight is another parasitic plant somewhat like the apple scab, but more minute and perhaps working deeper into the tissues of the leaf, often causing all the leaves to drop from the trees. This fungus also causes the scab and cracking of the fruit so common on the White Doyenne and Flemish Beauty. For the insects Paris green is effectual, and the Bordeaux mixture has proved as efficient for the pear fungus as for the apple scab. While the fire-blight (so-called) is not of such a nature as to be affected by the outward applications of fungicides after it has attacked the tree, we believe that this mixture will destroy any germs with which it comes in contact, and that by careful attention to the proper condition of soil, manuring, and cultivation we may very largely overcome this most destructive disease.

THE PLUM.—The plum curculio, the black wart of the tree, and the rotting of the fruit have been found to succumb to the Bordeaux mixture and Paris green.

The only trees on the college grounds upon which the fruit was not stung by the curculio or that did not rot as soon as it approached

maturity, were those treated with the above combination, and as other stations report similarly favorable results we feel warranted in urging its general use. The sulphate of copper solution should be applied to the branches before the leaves unfold, to destroy any germs or spores of the leaf blight or plum wart that may be present, and then from the time the blossoms fall until the first of July the combined mixture should be used. After this, either the Bordeaux mixture or the ammoniacal carbonate of copper alone may be used. The latter will probably be the most satisfactory as it does not disfigure the fruit.

The plum wart we feel sure was largely prevented from developing by this treatment, but the few warts that may secure a hold on the branches can certainly be destroyed by the kerosene paste.* This should be applied with a brush in order to keep it from the new bark, which it would destroy.

THE GRAPE.— In the college vineyard the past season the benefits derived from the use of the Bordeaux mixture — and we have like reports from others wherever used — were such that there seems to be but little doubt that this is a reliable remedy for about all of the fungous diseases of the vine. The great objection to its use is that it remains upon the fruit when ripe if applied late in the season. But after the work of the rose bug has ceased I see no reason why the ammoniacal carbonate of copper may not be used with equal effect.

In our experiments the destruction of the rose-bug by the use of Paris green was not fully demonstrated, but other reports are more positive; and from the light we did gain by our work we believe that, by the use of a more concentrated solution, which it has been proved we can apply with the Bordeaux mixture, this troublesome pest must succumb to this treatment.

The sulphate of copper solution was applied to the vines before the leaves unfolded and the Bordeaux mixture at intervals of from one to three weeks up to July 28th. Paris green was used only from the time the rose bugs made their appearance to about the first of July.

THE STRAWBERRY.—During the spring and early summer, strawberry leaves in some localities are seriously injured by a small brown beetle that feeds upon them. This little beetle is the crown borer, the larvæ of which are at work during the summer eating

*See formulæ, page 65.

the crown of the plant and the larger roots. A serious disease, known as the leaf blight, also attacks the foliage at about the time the fruit ripens, and when both of these agencies are at work it is a difficult matter to get rid of the trouble. It is thought that Paris green will destroy the crown borer, and it is certain that the Bordeaux mixture will lessen the injury caused by the blight, if not wholly prevent it.

An application of the combined mixture should be made as soon as the leaves begin to increase in growth in the spring, and another a little while before the blossoms open. Neither the Paris green nor the Bordeaux mixture can be safely applied again until after the fruit is gathered. By this time the crown borers have ceased their work and only the latter need be used until August, when the beetles again appear and Paris green must again be used.

The cutting and burning of the leaves of the old strawberry bed or their destruction by dilute sulphuric acid, as recommended by some, is undoubtedly valuable, but the Bordeaux mixture is thought more effectual. If one fears to use the Paris green, hellebore may be used, as it is reported as being an effectual remedy.

FUNGICIDE FORMULÆ.— *Bordeaux Mixture.* Dissolve 6 lbs. of sulphate of copper in 2 gallons of hot water; slake 4 lbs. of fresh lime in water enough to make a thin lime wash; when both are cooled pour together, stirring thoroughly; then dilute to 22 gallons and it is ready to apply.

Ammoniacal Carbonate of Copper. Dissolve 3 oz. of precipitated carbonate of copper in 1 quart of ammonia (strength 22° Baumé), and dilute with 22 gallons of water.

Eau Celeste. Dissolve 1 lb. of sulphate of copper in 25 gallons of water.

Modified Eau Celeste. 2 lbs. of sulphate of copper, 2½ lbs. of carbonate of soda, 1½ pints of ammonia (22° Baumé), and 22 gallons of water.

Kerosene Emulsion. 1 lb. of common soap dissolved in hot water, 1 gallon of kerosene; stir or churn together until a smooth butter-like substance is formed; then dilute with 25 to 50 parts of water.

Kerosene Paste. Mix kerosene with any fine, dry material or pigment, forming a thin paste or paint; apply with a small brush.

INSECTICIDES.— In the discussion of insecticides I have mentioned only Paris green, from the fact that reports from all sources

agree that it is less injurious to plant foliage than London purple, and white arsenic is unquestionably too dangerous a material to have about, from its color not being distinguishable from that of many harmless substances.

PUMPS.— Many forms of pumps are now to be found in the market adapted to applying the fungicides and insecticides mentioned. Of those most in use perhaps the "Field's Perfection," made at Lockport, N. Y., the "Gould," made at Seneca Falls, N. Y., the "Douglas," made at Middletown, Conn., and the "Nixon," made at Dayton, Ohio, are among the best. These are made to be attached to a cask which is mounted on a stone boat or wagon. The knapsack pumps which are serviceable for small garden plots and small vineyards would be more useful if some means were provided for filling without removing from the back every time. The "Excelsior," recently advertised by William Stahl, of Quincy, Ill., is made, I understand, after the design sent out by the United States Department of Agriculture. This is constructed after the pattern of those used by the French in treating their vineyards, but will not be largely used by Americans when the horse can be made to do the heavy work of carrying the liquids.*

NOZZLES.— A nozzle to distribute such liquids as the Bordeaux mixture must have an adjustable opening at the end. Among those to be found in our markets are the "Perfection," sent with the Field pump, the "Nixon," the "Cyclone," and the "Vermorel." Professor Bailey, of Cornell University, has contrived a clamp which is attached to the end of a common rubber hose, by the pressure of which the size of the opening is quickly adjusted. Whatever nozzle is used it is found that it must be attached to a long pole to distribute the liquid most evenly at the top of large trees.

NOTES.— Many interesting facts have been brought out in the work of the Experiment Stations of the country which could not be referred to in the previous discussion, and I therefore introduce them here, condensed under the heading of "Notes."

It seems pretty well settled that, of the arsenites, Paris green gives the best results as an insecticide.

That the longer the mixture stands the greater is the injury from soluble arsenic.

---

*Since this paper was read further trial of the Stahl or Excelsior pumps has proved that some of them, at least, are of no value.

That the peach, plum, and cherry are more susceptible to injury than the apple and pear.

That the injury varies with the variety, some being much more susceptible to injury than others.

That the leaves when young are less injured than when fully developed, and those on weak trees more than those on vigorous, healthy ones. Young leaves are covered with a natural bloom, which wears off as they increase in size and their tissues become more toughened.

That Paris green cannot be used alone with safety stronger than 1 lb. to 350 gallons, but with lime mixtures it may be safely used at the rate of 1 lb. to from 100 to 25 gallons of water.

That the foliage is most injured when kept constantly wet by light rains or foggy weather, but that heavy rains lessen the injury, the least harm being done in pleasant weather when the liquid dries off most rapidly.

That the time of day when the application of either insecticides or fungicides is made is unimportant.

The conclusions of this paper I have arrived at after a careful summary of the experiments made at the College and a careful study of those of all of the stations of the country and I feel confident that as soon as we master the details of the application of the two great remedies, Paris green and the copper solutions, so as to understand the exact time to apply them and the quantity to use under varying conditions, we shall be able to control the insects and fungi attacking our fruits as well as we now control the "potato bug."

Professor Maynard's essay was illustrated by many mounted specimens of fungi which destroy fruit plants; also by several forms of nozzles made for use in applying liquid fungicides and insecticides to infected trees, shrubs, etc. The reading commanded the close attention of a larger audience than had been present at any preceding meeting this season.

Discussion.

William D. Philbrick questioned the essayist concerning the disease affecting the violet.

Professor Maynard replied that the violet disease is unquestionably of fungous origin; that we often find masses of dust-like spores upon dying and dead leaves, but it cannot be determined from this fact alone whether that fungus caused the disease which destroyed the leaf. Mildews of this character generally develop on decaying matter.

Mr. Philbrick asked whether it could be easily decided what fungus causes the disease and how it is disseminated.

Professor Maynard replied that two species of fungus are found on the leaves of violets, but apparently the disease is caused mainly by one. The spores when mature are exceedingly minute — so light as to be thrown off by the slightest motion of the leaf, and remaining suspended in the air a long time they are widely distributed by the varying currents of the wind.

Benjamin P. Ware asked if he understood the essayist aright, that one pound of Paris green to three hundred and fifty gallons of water was generally the proper mixture to destroy insects without injury to the foliage of trees. In his trials of this remedy he had used only sixty gallons of water to one pound of Paris green, and had seen no injury come to the trees.

Professor Maynard said there are many reasons for variations in experience — different conditions of seasons, the weather, the quality of the Paris green, and the chemical character of the water. He had found that one pound of Paris green to three hundred and fifty gallons of water had given fairly good results on an average. In some cases injury had been done to the leaves by that mixture, but numerous experiments, and analyses of the compound as prepared at different times, had led to the adoption of that formula. If the mixture stands a while unused, some of the arsenic may be dissolved in the water and thus render it unsafe.

Mr. Ware said he had tried to get pure Paris green. Possibly what he had used might have been adulterated, inasmuch as the large quantity used did no harm to the trees, but it destroyed the insects. He had supposed that Paris green was insoluble, and that in the mixture it was only held in suspension.

Professor Maynard said that water might contain some ammonia, which would tend to free a portion of the arsenic; this would dissolve readily in the water and the mixture would become harmful.

President Spooner referred to the Black Spot fungus (*Actinonema rosæ*, Fr.) which appeared on the rose leaves in the Durfee Plant House, on the Agricultural College grounds at Amherst, as reported in Bulletin No. 6 of the Hatch Experiment Station, and asked about the sequel of the treatment with the eau celeste compound.

Professor Maynard did not know that any black spot on the rose leaves had appeared in the Durfee Plant House since the use of evaporated sulphur was adopted. He believed the fungus was entirely destroyed by that treatment.

William C. Strong called for further information as to the treatment of the Black Wart with kerosene.

Professor Maynard said that the black wart should be treated at once upon discovering its presence, by an application of the Bordeaux mixture, and followed up by another application of the same remedy every two weeks, as a new crop of the fungus spores (*Plowrightia morbosa*) will generally mature in that time, and continued until no evidence of fresh spores can be found. If applied in the spring, the eau celeste liquid will destroy these germs, but if they become established the knife will have to be used, and the wounds thus made should be covered with a coat of paste, composed of some ochre or whiting, or any other of the dry, earthy pigments, mixed thoroughly with kerosene to a consistency that can be readily spread with a brush over the exposed surface without running beyond the limits of the wound. This would protect the surface from atmospheric action, kill the wart, and prevent the development of any fresh spores which might fall upon it. He had visited a plum orchard in Lancaster, which was literally breaking down from the development of black wart. In that case nothing could be done but cut off all the tops. Should a dressing of hen manure and ashes be applied to the land the trees would, in due time, produce new and healthy tops. Allusion was also made to the wild choke cherry as a much neglected propagator or nursery of the black wart.

Nathaniel T. Kidder called attention to Professor Maynard's remark about the wild cherry trees, which are infected with not only black wart but sundry insect pests. He wished to impress this fact upon the minds of all present, and would like to encourage a war of extermination against the wild cherry because of its availability for the multiplication of these enemies to fruit production.

Mr. Strong asked about the extent to which cutting out the black wart should be carried.

Professor Maynard said the diseased portion should be cut out clean. The rootlets (mycelium) penetrate deeply into the wood, and if not all removed the disease continues to extend; therefore a partial cutting is a waste of time.

Mr. Strong thought that if that were the case, prevention, if possible, would be much better than cure.

F. L. Temple inquired if the fungicides are not injurious to the trees.

Professor Maynard replied that it is only when the remedies are too strong that any harm is done to the trees.

Mr. Temple related an experience in treating *Prunus Americana* with salt. The black wart was cut out and the wound covered with cloth which was first dipped in pickle from a pork barrel. The wetting was repeated often and followed up several weeks with such good effect that the trees were kept in bearing condition for years by this method.

Mr. Philbrick spoke of a rust which had affected the leaves of maple trees over a considerable area in this State, and asked for information about it.

Professor Maynard replied that the rusts or blights of many forest trees are of similar nature to the apple scab, and referred to the "Journal of Mycology," Vol. 2, page 13, 1886, where the rust mentioned by Mr. Philbrick is shown to be caused by *Phyllosticta acericola*, which was found in New England in 1874, and in various other parts of the United States at sundry dates since; that it attacked Maples, and that other somewhat similar fungi affected Poplar trees and some other sorts. The effect of their presence in all cases is much like that of the apple scab.

William H. Hunt asked if white arsenic is just as good as the crude form for use as a remedy.

Professor Maynard replied that white arsenic is just as efficacious as the other forms mentioned; but if the preparation were allowed to stand a while after being mixed, the arsenic, by the evaporation of the liquid, would become very much stronger in proportion and the longer it remained unused the greater would be the proportion of arsenic. Then, if used again without the necessary addition of water, it would be liable to injure the plants, and might destroy all the foliage. But another objection to the use of white arsenic for this purpose is that it bears so close a resemblance to other and harmless substances that there is danger in having it about the house, where it may be used in place of one of those, and produce fatal effects. Paris green mixtures also become injurious by standing unused, and the more so in proportion to the time they stand.

Francis H. Appleton asked if the blight on birch trees is of insect or fungus origin.

Professor Maynard said that many birches turned brown last autumn from the work of a minute insect which is protected by a shell, probably of its own making. This enemy has increased to abundance during the last two years, but has not yet been identified. Its work was manifest generally through the eastern part of the State, but not so much in the western counties. He would suggest that probably Paris green would destroy the worms attacking the birch trees.

Mr. Strong asked if the remedy would be adapted to rid the trees of the red spider which now destroys their beauty.

Professor Maynard thought the sulphur and lime solution would suffice to remove the red spider. It punctures the leaves and sucks out the sap. Arsenites destroy only those insects which eat the foliage, but the kerosene emulsion, the formula for which is given in the essay, might also be an effective remedy for the insect injuring the birch.

O. B. Hadwen had noticed the discoloration of white birches at the north of Worcester, and beyond Concord, N. H., and west to near Springfield, but not much at more southern points. If the ravages of the new comer keep on, great injury will be done to our fine cut-leaved birch trees.

At the conclusion of the discussion a vote of thanks to Professor Maynard for his able, interesting, and very instructive essay was unanimously passed.

The Chairman of the Committee on Publication and Discussion announced, for the next Saturday, a paper upon "Chrysanthemums," by John Thorpe, of Pearl River, N. Y.

BUSINESS MEETING.

SATURDAY, February 7, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

The Committee appointed at the last meeting to nominate a Committee on Window Gardening, reported the names of the following members:—

Mrs. Henrietta L. T. Wolcott, *Chairman*,

E. H. Hitchings,	Edmund Hersey,
Henry L. Clapp,	George A. Parker,
M. B. Faxon,	Miss Mary L. Vinal.

The report was accepted and the persons named therein were unanimously elected.

The Committee appointed on the 3d of January to nominate a candidate to fill the vacancy in the Committee on Vegetables, reported the name of Joseph H. Woodford, who was unanimously elected.

The following named persons having been recommended by the Executive Committee for membership in the Society were upon ballot duly elected.

William P. Park, of West Boxford,
Warren Howard Heustis, of Belmont,
Charles W. Prescott, of Concord,
Charles E. Weld, of Roslindale.

Adjourned to Saturday, February 14.

MEETING FOR DISCUSSION.

Chrysanthemums.

By John Thorpe, President of the American Chrysanthemum Society, Pearl River, N. Y.

If it had been predicted ten years ago that the Chrysanthemum would attain to the position it now holds, it would have been said that such a thing was impossible. Let us for a moment look about for the cause of the chrysanthemum's popularity. It did not come in a night, a week, or a year, but it has taken twenty years to bring about what we are enjoying today.

When Robert Fortune sent to England his first consignment from Japan it was there that the first spark was kindled. An intelligent minority were far-seeing and wise enough not to be disheartened or put down by the many who were wedded to the paucity of form and color possessed by the puritanical varieties of

that day. Furthermore, that minority was not confined to one house, one city, or one continent. Many members of your Society—the greatest horticultural society in the world—happily belonged to Fortune's minority, one of the most prominent being your Ex-President, Dr. Henry P. Walcott. It was the work of time, love, and the expenditure of much money, to spread before the people the feast which they now annually enjoy, but everything comes to him who waits.

It is but a few years since chrysanthemum shows were unknown except perhaps in your city, New York, and Philadelphia. The numerous exhibitions held last season, numbering nearly fifty, are proof of the progress the chrysanthemum is making.

I do not intend to give you the routine of general cultivation, as I am sure many of you know how to grow chrysanthemums better than I do. But there are a few points to which I desire to call your attention.

One is, never neglect a chrysanthemum. This ought to be written very plainly on every plant. No plant can be as successfully cultivated in as many forms; it matters not whether the plants are grown as massive specimens, tall standards, or on benches a few inches apart. If they receive the proper attention the result is always commensurate. The thousands of plants that are now required to produce fine flowers for sale have brought about a system differing entirely from that followed previously.

The plants are grown continuously under glass and are treated as follows. Good, strong cuttings are rooted in May. The plants are potted into thumbs, from thumbs into three-inch, and from three-inch into five-inch pots. In June or the early part of July they are planted in benches, from sixteen to twenty-four inches apart, according to size, the soil being the same as for roses and from four to six inches deep. They are pinched back so as to give from four to six shoots, carefully trained and well supported, syringed often, and watered carefully. Air is given at all times, provided no draught is created. The buds are selected at the end of August or the beginning of September, one bud to each shoot; the rest of the buds are rubbed off, and all superfluous wood is removed. As the plants grow they are tied, and as soon as the buds are well in sight the feeding with liquid manure commences. It is necessary to state that such plants require at least five feet of head room; otherwise they have to be bent down.

Some cultivators do away with benches altogether, and plant in the ground. Others do not plant until August, using smaller plants, which they place closer together — often not more than six inches apart. During the flowering season air is kept on at all times, and fire heat enough to keep the temperature at fifty degrees at night.

The grouping and classification of varieties is now in a somewhat ambiguous and unsatisfactory state, but is worthy of serious attention. Exactly how to bring about what is required is a difficult matter, owing to the continual addition of new forms and the merging of one section into another, thus often obliterating the lines of demarcation.

Perhaps as a temporary relief the best thing to do is to accept the classification (as far as it goes) of the National Chrysanthemum Society of England, which is as follows:

Section I. Incurved, of which George Glenny and Queen of England are the type.

Section II. Japanese. This is divided into three groups:

Group 1. Flat petals; type, Peter the Great.

" 2. Petals quilled; type, Bronze Dragon.

" 3. Petals fluted; type, Cossack.

Section III. Japanese incurved. Type, Comte de Germiny.

Section IV. Japanese reflexed. Type, Elaine.

Section V. Reflexed. Type, King of Crimsons.

Section VI. Large Anemones. Type, Georges Sand.

Section VII. Japanese Anemones. Type, Fabian de Mediana.

Section VIII. Pompons. Type, Bob.

Section IX. Pompon Anemones. Type, Antonius.

Section X. Single Flowers.

But this does not cover all the ground; Mrs. Hardy and her type have no place, neither has Violet Rose nor Ada Spaulding.

The raising and distribution of seedlings has assumed proportions beyond conception, from which we may expect startling results. Of American raised seedlings to be distributed this spring, the number is over one hundred and twenty. Taking into account the number distributed last year, out of which there are at least fourteen that rank among the very finest, we may expect that at least twenty-four of this year's introduction will be among the best at next flowering time.

It is hoped that due care will be exercised in the awarding of medals and in the granting of certificates, now that there are so

many to select from. A rule should also be made absolute, that neither a medal nor certificate shall be given to any seedling unless it is named, and that this name is not to be changed. The giving of medals and certificates to seedlings bearing numbers only, is calculated to mislead and confuse. I do not wish it to be understood that I object to the exhibition of seedlings under numbers when they are placed there for exhibition only, but as soon as they enter into any competition let them be properly named.

It is also hoped that in making awards to seedlings neither Anemones, Pompons, nor any other type will be overlooked or discarded, as it is in the varied forms that so much interest lies.

It has been asked whether very early kinds are desirable. My reply is that with one or two exceptions the very early varieties we now have are not of great merit. They lack either vigor, distinctness, or brilliancy, all of which they should possess as decorative plants. But suppose we have presented to us a group of robust, compact growth, bright and decidedly healthy foliage, flowers of the type of and as large as President Hyde, and in desirable colors, flowering from the fifteenth of September — what could be more attractive? We are promised such a group and they will be heartily welcome.

Just as long as there are produced new types and new shades of color, just so long will the interest in the cultivation of the chrysanthemum be kept up. We have but to recall the interest which that beautiful variety, Mrs. Hardy, and her followers created. Now we are evolving a type which is certain to create further interest. Its distinctive characteristics are the marked extension of the ray florets beyond the body outlines of the flower. Examples are Violet Rose, Ada Spaulding, and Flora Macdonald. The ligulate petals are broad, numerous, and incurving. Perhaps a good name for this type would be "American." Yet another type, the original of which is Laciniatum, one of Fortune's importations from Japan, is being developed in all colors and in the largest sizes. Still another form, distinct in every particular, is one where the flowers present two distinct surfaces, the upper surface being composed of broad reflexed petals, and the lower surface being a mass of narrow segments which extend from either side of the base of each floret. These are only a few of the newer forms waiting to be brought forth.

That there is a constant addition to the already numerous shades and tones is known to close observers. The pink shades are each

year becoming clearer; the reds and crimsons are getting brighter. The once undefined shades of purple are decidedly more brilliant and effective. As to yellows and white we are yearly presented with something different from what we previously had.

Coming now to the possibility of a blue chrysanthemum, let me say that I am convinced we shall have shades of blue as certainly as we now have blue shades in pansies. It is within the memory of a great many of us when there were neither red nor blue shades as presented in the pansies of today.

Grave doubts have been expressed whether actual cross-fertilization has ever been accomplished artificially in chrysanthemums. I can say without the shadow of a doubt that it has been, but I do not say that every variety can be so crossed. All flowers intended to be fertilized must have their petals clipped off close to the stigma before the flower opens. This admits of the development not only of the stigmas but of the ovary also. Some varieties will be found entirely sterile; Grandiflorum has never yet given me a single seed, and, so far as I am able to tell, the pollen grains are sterile also. Where cross-fertilization is carefully and successfully done, fewer seedlings give better results.

The possibilities to be obtained by selection are just as great with the chrysanthemum as with any other class of plants or animals. In fact, wherever seedlings are raised it is by selection that we retain any varieties, whether they be large flowered or small, tall plants or dwarf. It is by selection that after a few generations each raiser creates a standard of his own, by which his productions are known. It is simply this: You have different material and different ideas from mine; consequently the result must be different.

From a strictly commercial point of view the chrysanthemum has become of national importance.

The annual sale of plants is now over a million. The number of cut flowers that were sold in open market last year is almost incredible, many of the best flowers realizing fifty dollars per hundred at wholesale. Some of the large growers around New York had as many as fifty thousand flowers in sight at one time, averaging a great deal better in quality than many of the winning flowers that were to be seen on the exhibition tables but a few years ago.

It has been said that the chrysanthemum flowers interfere with the sale of roses and carnations, but I notice that nothing interferes with chrysanthemums in their season.

DISCUSSION.

Leverett M. Chase asked about the character of the new, early blooming varieties advertised in Europe, particularly those raised by M. Delaux, in France; also how they thrive in America,—a point of importance to those who have no greenhouse.

Mr. Thorpe replied that with one or two exceptions, the early flowering varieties raised in Europe have not given satisfaction here, owing to their being unable to withstand the excessive heat of our summer. It is reasonable to expect that a few of the many early varieties offered by Delaux, will succeed here, but how many will have to be proved by trial. The moist and temperate climate of France and England, where chrysanthemums do well out of doors, is very different from ours. If we desire to succeed in raising a series of early flowering varieties to withstand the variations and vicissitudes of our climate, we must raise our own seedlings and save none but those that stand the ordeal to which they are subjected here. In other words they must be to the manor born.

M. Delaux claims for his set that they will begin to flower as early as the fifteenth of July. We have already several pompons that would flower by that date provided that they could be made to grow. The speaker thought that what we require is a series, beginning to flower not earlier than the first of September, having the characteristics mentioned in the essay. M. C. Nichols is a variety having some of these good points; it is a sturdy grower and has thick, leathery leaves; the flowers are of medium size, rather undecided in color, and bloom about the fifth of October. Harvest Queen is a good white, as is also Mlle. Lacroix; these flower about the fifteenth of October. The flowers of the last two are much better when grown under glass.

Richard T. Lombard inquired what Japanese variety Mr. Thorpe esteemed the best for cut flowers, for market.

Mr. Thorpe said that depended on what color was desired. If white, he named Jessica. The best yellow is Rohallion, blooming the tenth of October, followed by Gloriosum, about the fifteenth. It is astonishing how much difference five days make.

In reply to a question as to what variety remains longest in perfection, Mr. Thorpe said that it depends on the time of the year. The duration of bloom varies from fifteen to twenty-five days. By judicious selection and special cultivation chrysanthemums can

be had in bloom from the first of January to the last of December. Probably the blooms will not all be up to first-class grade as to form, size, color, and quality, as when flowered in the autumn, but they will possess enough good points to make them acceptable. For ten years he had never been without chrysanthemum flowers. We have to remember that they are herbaceous plants which after they start to grow keep on until they have produced buds, flowers, and — if they are natural — seeds, which completes their work. But he did not think much was gained by interfering with their natural time of flowering; as we know that strawberries are best in June, so chrysanthemums are best in November.

President Spooner spoke of the practice of awarding medals or other prizes for seedlings, upon the exhibition of their first flowers, and asked Mr. Thorpe if he thought it wise to do so, or better to postpone the awards until after a trial of two years or longer had proved the real merits of the new variety.

Mr. Thorpe replied that the first year his seedling, Mrs. Cleveland, flowered, he thought it a capital prize. It was propagated and sold the following spring, but when it flowered the second year, instead of proving itself a gem of the first water, it came down as low as third class. Yes, seedlings should always be tested more than one season, and no prize should be awarded to any until its superiority in character and habit is fully established. He said also that it is unwise for a grower to offer to the public any new plant or flower until its merits are shown to be greater than those of existing kinds, especially where varieties are so numerous and in many cases so excellent.

E. W. Wood congratulated the company present upon this opportunity to hear what Mr. Thorpe had to say upon this subject. The essayist was the man of all men in this country who could tell us most about chrysanthemums, their propagation and culture, the production of new varieties, the selection of varieties for special purposes, and all other important points. His paper gave but little of what he knows about this matter. All he knows could not be told in one lecture. We know that great progress has been made recently in the improvement of the chrysanthemum. The enthusiasm aroused in this work extends from the Atlantic to the Pacific, and in view of late successes there is no prospect of its decline in the near future. The great improvement of these plants has involved changes in the methods of their culture as great as are the changes in their character and the use made of them. To

meet new requirements of market and exhibition both the plants and flowers will, to a largely increased extent, be grown wholly under glass. But as in the past the chrysanthemum has been mostly grown in the open air, for home use in house and garden decoration, we shall like to continue that custom, and trust it will be continued. For this purpose smaller plants in larger numbers — each of which will remain in bloom from two to three weeks — will allow us great variety, improved quality, and largely increased enjoyment. In conclusion Mr. Wood asked Mr. Thorpe about the insect pest which prevents the perfect development of many chrysanthemum plants and flowers.

Mr. Thorpe said that Professor C. V. Riley, of the United States Department of Agriculture, had taken a great deal of interest in the investigation of this insect, which attacks not only chrysanthemums, but asters, golden rods, and other composites. The female stings the plant when she deposits her eggs, causing a disorganization of the sap which is shown by numerous excrescences. The best remedy he knew of is a solution of one ounce of bitter aloes in four gallons of water, with which to syringe the plants twice a week, from the first of July to the middle of August.

In answer to another question, Mr. Thorpe said that if one desires to grow plants in the open ground, to be shifted into pots for late blooming in the house, it is necessary to select such varieties as can be well grown out of doors,— those having a compact habit and bright, clean, healthy foliage that does not suffer from the attacks of either white mildew or black rust. This black rust is a Peronospora, closely allied to the potato fungus. Ada Spaulding, H. E. Widener, and Violet Rose, are kinds having many good and desirable qualities as mentioned before.

There are many of the finest, old style, incurved flowers,— which have representatives in Queen of England, Mrs. Shipman, and Princess of Wales — that do not succeed at all well here, while in England they are most popular and give great satisfaction. He had yet to see a really first class dozen of these kinds in America. They have suitable conditions over there to make perfect flowers on these varieties, which we have not here, and the difficulty must be climatic, as we have as much skill and as good appliances as the growers of any country.

In reply to the question whether there had been twenty-four Chinese incurved flowers shown in America, that would rank in

England as first class, Mr. Thorpe did not believe there had been twenty-four flowers shown here in one stand that would rank in England as second or scarcely third class. In regard to specimen plants of the old incurved kind, he said that they were not equal in quality to the cut flowers of that famous variety, Mrs. Rundle and her two sports, which always appear in competitive groups. In six varieties there are generally two out of the three Rundles, and when nine or more varieties are exhibited it is almost a certainty that all the Rundle varieties are shown among them.

A question was asked where were the best twelve Japanese varieties originated, — in Japan, America, France, or England? Mr. Thorpe replied that at this date probably the best twelve were direct importations from Japan, but added, that by next year, or the year after at the farthest, twenty-four American-raised seedlings will be in cultivation that will beat an equal number from any other country. From the fact that there are so many engaged in raising seedlings, and also because the standard of requirements has been raised so high, there are now a great many seedlings on probation. If they prove to be as good as when seen last season, they will give us these additional good varieties.

In reply to the question, what are the very best late kinds, to have in flower at Christmas, Mr. Thorpe named Mrs. Humphreys, Ethel, Mrs. H. J. Jones, and Governor of Guernsey, as ordinarily late flowering kinds; but it depends a great deal upon the manipulation of the plants. For instance, if the plants are allowed to become very dry in August, and the wood ripens, they will flower the middle of November; but if they are kept growing and the wood remains soft several weeks later, they will flower in December. The question is not so much when the cuttings are taken, as it is how continuously they are kept growing, from the time they are rooted, up to, say eight weeks before they are required to be in flower. Perhaps it would be better to take cuttings of late flowering kinds later, rather than very early.

Michael H. Norton asked for a list of names of the best half dozen varieties for market.

Mr. Thorpe said he would not attempt that. He would prefer to name one hundred — he did name fifty or more — and would leave the more select choice to his questioner, who would doubtless want them coming into the market from September 1, to January 1, consisting of all the popular colors, such as yellow, white,

pink, bronze, and red, and also a few fancy, or parti-colored varieties. Then, as has been observed, chrysanthemum flowers last about fifteen days, and as the term from the first of September to the first of January, is four months, or about one hundred and twenty days, it would take eight varieties of one color alone to cover the time. Thus it will be seen that for the five self-colors above named, at least forty kinds are required to meet the demand, and if parti-colored varieties are added, the number will be increased proportionately. Mr. Thorpe then gave the following lists — all of Japanese types — as being of great merit for market purposes during the period named. Those of French origin were:

Alcyon,
Belle Paule,
Boule d'Or,
Ceres,
Étoile de Lyon,
Jeanne Delaux,
L'Incomparable,
Madame C. Audiguier,
Margot,
M. Bernard,
Roi des Japonais,
Val d'Andorre.

Next came as many of the English varieties:

Carew Underwood,
Elaine,
Eynsford White,
Fair Maid of Guernsey,
James Salter,
Joseph Mahood,
Martha Harding,
Mr. Matthews,
Mrs. F. Jameson,
Stanstead Surprise,
Sunflower,
William Robinson.

The list of imported Japanese varieties included:

Christmas Eve,
Comte de Germiny,
E. G. Hill,
G. F. Moseman,
Kioto,
Lilian B. Bird,
Louis Boehmer,
Mr. H. Cannell,
Mrs. Alpheus Hardy,
Robert Bottomley,
Volunteer,
W. H. Lincoln.

The following American list was given:

Ada Spaulding,
Carrie Denny,
Cyclone,
Excellent,
G. P. Rawson,
Harry E. Widener,
Maudus,
Minnie Wanamaker,
Miss Mary Wheeler,
Mrs. Bowen,
Mrs. M. J. Thomas,
Violet Rose.

In reply to a question as to the possibility of producing a blue chrysanthemum, Mr. Thorpe said that a blue chrysanthemum was exhibited at Philadelphia, but unfortunately it was made of paper. However, he fully believed that we should live to see a genuine blue chrysanthemum. The old botanists declared that we could not have blue, yellow, and red in the same species of plant. But we have blue, yellow, and red hyacinths, and he saw no good reason why we should not get the same colors in the chrysanthemum. How limited were the original colors of the chrysanthemum flowers! They were a pale yellow, white, and a very weak lilac shade; and from these have been elaborated all the colors and shades we now enjoy in this flower. This has been accomplished by very slow and persistent work, in selection and cross-fertilization, and in the fixing of sports. Notice how intensified have become the yellows and how many shades there are. The lilac has become pink, of pure shading. Then as to red, Cullingfordii oftentimes, when the flowers are closely shaded, presents us with nearly a pure tone of red. The most pronounced purple we have today is a "sport" from the lightly tipped, incurved Princess of Wales. It is named Violet Tomlin and is really purple. Now we cannot get purple without blue, and to those who are hard at work in the field of development, a blue chrysanthemum would not be a very great surprise. Raisers of seedlings frequently see signs of a "new departure" four or five years before it actually takes place. The blue chrysanthemum may first be obtained from a sport.

Joseph Clark asked if the continual cross-fertilizing and high culture required to produce the large flowers now exhibited does not injure the constitution of the plants.

Mr. Thorpe said he did not believe that the constitution of the chrysanthemum had been impaired by continual cross-fertilization. On the contrary the American raised seedlings of the past three years have decidedly more vigorous habits than those of previous years. The principal cause of this is that our raisers of seedlings have now reached a point where they will throw away all weakly seedlings, except such as show some new features which it is desirable to develop in future generations. When his seedlings are about four months old, then being generally in three inch pots, he discards all plants of puny growth and constitutional weakness, thus doing away with all the bother of nursing them, and often the temptation to keep a weakling when in flower.

Rev. A. B. Muzzey, said we were told that Mr. Thorpe had devoted many years to the cultivation of the chrysanthemum; we expected, therefore, to learn from him a great deal, and we had not been disappointed. It had been shown that he had devoted his attention and labor to one flower; had thoroughly studied its nature, its needs, and its capabilities; and in its treatment and development he has been preëminently successful. In his showing here today we see what can be done by taking such a course in any department of our work. If one would succeed in horticulture, floriculture, or pomology, let him select some one object, fix his mind on it, study it from every stand-point and master it. Let it be in the spirit this man has shown today; being fully informed, he is ready to respond to all questions, on every point of his subject. Should our members generally adopt this system, however well we have done in the past, we should in a few years become a new Society. Let us always remember that patience is genius, and persistency is success in any undertaking.

George Hollis asked, Is the degeneracy of plants inherent in them, or is it the result of the treatment they receive at the hands of the grower?

Mr. Thorpe replied that he believed all plants — just like ourselves — have a natural period of existence, provided always that they are surrounded by natural environments. The chrysanthemum is an herbaceous plant fulfilling the purpose of its being in one year's growth, and its constitution is generally not only equal to its needs, but somewhat in excess. This enables us to multiply plants by cuttings, a method which is simply an extension of the life of the parent plant, and not a complete renewal of it as in propagation by seeds. Plants not raised in America, and which are propagated here only by cuttings, must have all the weaknesses of the original stock, with a shorter prospective existence. These remarks apply to plants that are to be used as garden plants,— where no more artificial protection is given, than is provided for a geranium or other summer flowering plant. On the other hand, in the raising of American seedlings for a given purpose — as for instance, to produce a thoroughly reliable race of garden plants — we will suppose that at any time during May five hundred seedlings are planted in the open ground and are given fairly good cultivation. There will come a time when some of these plants will begin to weaken, that is, they will make no further progress, and as the trying summer lengthens many others

will drop behind, until — probably at the end of September — your five hundred seedlings have dwindled to only fifty healthy and vigorous plants. It will be these fifty then, that have the constitution and the vigor you desire to propagate. He had often said that we ought to raise American seedling plants for American gardens. A great many of the European novelties of all kinds of plants are failures here. It is not that they are worthless, but because the conditions to which they are subjected here are not to their liking.

Mr. Hollis further inquired, if the best health of stock is to be maintained, which course is best to pursue in propagation; to take cuttings from a plant which has been forced to its highest capabilities in order to produce large specimen blooms, or from another plant of the same variety which has received only such culture as will ensure merely good ordinary flowers?

Mr. Thorpe said his experience had afforded him such positive proof as to the growth of chrysanthemums, that he believes that when cuttings are taken at a fairly early time, it makes no difference whether they are cut from a strong plant or a weak one, provided always that they are properly treated afterwards. A cutting no thicker than a knitting-needle, if well cared for from the start, should be as strong at two months later date as one that was originally as large as a pencil. Some believe that permitting a plant to produce only a few flowers tends to strengthen the plant. The fact is, it costs the plant less effort to elaborate one flower than it does to perfect fifty. If a plant is allowed to carry all its flowers without disbudding, what a task it has. A single shoot of some varieties has as many as forty buds formed, and when we consider that each flower when open carries from one hundred and forty to one hundred and fifty florets, we can perceive that the strain on the plant is a very severe one.

Michael H. Norton expressed his pleasure that he had been present and heard the very able and instructive lecture, and he moved a vote of thanks to Mr. Thorpe, which was unanimously passed.

The Chairman of the Committee on Publication and Discussion announced for the next Saturday, a paper upon "Small Fruits, particularly the Strawberry," by P. M. Augur, State Pomologist, Middlefield, Conn.

BUSINESS MEETING.

SATURDAY, February 14, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

Joseph H. Woodford, Chairman, presented the following report:

The Committee, appointed to report recommendation of compensation for the various Committees on Exhibitions, report:

One hundred dollars to each of the six Chairmen, and one dollar each for other members whenever they attend as required by the Schedule; an account to be kept by the Chairman.

J. H. WOODFORD,
H. P. WALCOTT,
C. H. B. BRECK,
} *Committee.*

The Report was unanimously adopted.

O. B. Hadwen, Chairman of the Committee on Publication and Discussion to which was referred the award of prizes for the best reports of awarding Committees, presented the following report:

The First Prize to Joseph H. Woodford, for the Report of the Committee on Plants and Flowers.

The Second Prize to Charles N. Brackett, for the Report of the Committee on Vegetables.

The Third Prize to E. W. Wood, for the Report of the Committee on Fruits.

The report was unanimously adopted.

The Secretary announced the receipt of a letter from the Secretary of the State Board of Agriculture, accepting the invitation to hold its winter meeting in the Society's Halls, and stating that the meeting would be held on the first, second, and third days of December next.

Adjourned to Saturday, February 21.

MEETING FOR DISCUSSION.

The Strawberry and Its Culture; Theories and Methods.

By P. M. Augur, Connecticut State Pomologist, Middlefield, Conn.

The time was when the Strawberry was regarded as a luxury for occasional use only; now it is justly considered a necessity. So much so is it, that a failure of the strawberry crop would be considered almost as deplorable as a potato famine, at least during the season when we usually have them. Formerly a few crates answered the demand in any one market; now the daily supply of our principal cities requires long, ponderous trains of cars, loaded with this most delicious early summer fruit. No apology, therefore, is needed for devoting our thoughts today to the consideration of the current theories and approved methods now practiced in the highest strawberry culture.

In noting the progress in this line, which has been made during our recollection, we see a change as great as that between the little packet ship of our boyhood days, and the great palatial ocean steamer of today. Again, when we compare a quart of selected strawberries, of the best type we knew sixty years ago, with the fine exhibition berries of the Sharpless, Belmont, and Jewell, as they appear on your exhibition tables from year to year, we are indeed amazed; and yet this is only in harmony with the rate of progress we observe in almost every department of human effort.

Therefore, standing as we now do on the threshold of the last decade of the nineteenth century, let us look forward and see where lie the opportunities for higher development and more complete success in this interesting department of horticulture.

First, then, let us consider the subject of culture as having a most important bearing on strawberry production, and being a most important factor in achieving it. If we turn to mechanics for an illustration we find that the same metal, under different methods of handling, may be made into either a stone-hammer or a watch-spring—the latter, of course, requiring a far higher degree of skill than the former, with a consequent higher value. So also a given piece of land may under a certain management yield a crop of potatoes worth one hundred dollars; the same land may under very different management yield a crop of strawberries worth ten times as much. Let it not be inferred from this that

a strawberry crop may be regarded as necessarily worth ten times as much as a good potato crop. This depends upon circumstances. The chances are, however, that under good management the strawberry at its maximum will far exceed the potato in value.

The question then comes: "What are the conditions, culture, and surroundings needed for the highest results in strawberry productions?

First, the soil. A very sandy soil is least desirable; a strong, retentive loam, well handled, the best. Taking the latter as our beau ideal, let us consider the best mode of management. We are aware that such soils have a tendency to become too heavy and compact; in a very wet season they may be soggy with water, and in extreme drought be hard and cracked. To avert the former tendency by removing surplus water, artificial draining is necessary, and at the same time it will give aëration and good mechanical condition to the soil: these are prime conditions never to be overlooked.

As the soil is the home of the plant, in order to achieve the best results all the conditions must be most favorable. The soil also being Nature's grand laboratory, we must remove all obstacles to her work, at the same time carefully supplying every requisite condition for speedy and most effective operations.

We will suppose a soil of good natural fertility but a little heavy and tenacious. We will give thorough drainage by placing underdrains thirty feet apart and three feet below the surface, to be laid on perfect grades running directly down the slope. The effect of these will be to render the soil less adhesive and more porous and friable.

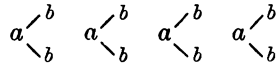
For the immediate improvement of this soil both in fertility and mechanical condition preparatory to a strawberry crop, supposing it to have been preceded by a cultivated crop, apply from twenty-five to forty cords of grain-fed horse manure, well fermented but not burned. Let this be plowed in nine inches deep, plowing across the drains, following in each furrow with a sub-soil plow running nine inches deeper, thus breaking the soil half-way down to the drains.

This operation will secure aëration from above and from below, and with the fertilizing and mechanical effect of the horse manure intermixed in the soil will furnish a most congenial home for the strawberry, and furthermore we believe that decomposition and

nitrification will go on conjointly, through the agency of micro-organisms, the whole becoming more digestible and available for superb growth and magnificent fruitage of the plants. Again, such a soil so treated is in condition to withstand extreme vicissitudes of wet and drought better than any other; easily letting off surplus water through the drains and as easily drawing moisture through its numerous capillaries from the water table beneath. The way in which lettuce growers prepare their beds is an ideal way to prepare ground for strawberries.

Having a soil prepared as described, and nicely pulverized, plant according to some definite system. Usually planters adopt the matted-row plan, setting the plants at varying distances according to the variety and the intent of the grower. We follow that plan too, to a considerable extent, because of the demand of the public for plants, having a double object,—plants and fruit. But from the stand-point of fruit production alone we should discard the matted-row system as both unphilosophical and unwise. What grower would plant corn in the matted-row to secure good ears, or beets in the matted-row to secure good roots? Cobbett, the old English gardener, said, "one or two cucumber plants in a hill are better than more, and with fifty plants in a hill you get no cucumbers." Unnecessary strawberry plants in a bed are as injurious as weeds. The maximum yield of a well developed strawberry plant may without doubt be placed as high as two quarts; I have excellent proof of this from my own experience. But this cannot be reached without space for full development.

For spring planting for fruit alone, I know of no better plan than to set in rows three feet apart and one and one-half feet in the row, allowing each spring-set plant to throw one strong runner on each side, rooting a single plant opposite the intervening space, thus:—



a, representing the spring-set plants, and *b*, the new plants from runners, so that each plant in the trio *a*, *b*, *b*, will stand at a corner of a triangle. This method of planting is particularly adapted to the Jewell.

For July planting select strong young plants and plant in rows two feet apart and one and a half feet in the row. If trying for

the greatest number of bushels I would plant a foot and a half apart each way. Just after a rain each plant can be taken up with a ball of earth adhering. Hoe frequently and keep all runners nipped off. Cover with coarse hay as soon as the ground is well frozen, removing as soon as the ground ceases to freeze in spring. Then give a shallow hoeing, and when the fruit begins to color mulch sufficiently to conserve moisture and keep the fruit clean. By the last of May such plants should touch each other both ways and yield on an average one quart per plant in June; thus showing a possible yield of 472 bushels per acre for the July planting, or 313 bushels for the previous spring planting, the young plants *b*, having higher possibilities than the older plants *a*. I do not intend to convey the idea that everyone everywhere can achieve such a result, but simply that it is possible, with all the conditions favorable, as we have ample proof to demonstrate. Fruit of the best quality is never rejected in the market.

Before leaving the matter of culture, allow me to say that in all the processes of stirring the soil, unnecessary tramping of the ground by either teams or men should be avoided. In any horticultural operation there should be convenient paths for travel exclusively, and no man or team should go elsewhere than in the paths when it can be avoided. Many men in hoeing and weeding, by frequent and unnecessary stepping actually do more harm than good. Implements for horse and man should be so constructed as to do the most work possible with a single passage or movement, and should also be as light as possible, compatible with strength and efficiency.

To go into all the minutiæ of mode or frequency of culture, I think unnecessary before an audience of experts, such as is convened here.

How shall we avoid deterioration of varieties, and keep our stock good for continuous vigor, health, and productiveness? We may justly regard this as one of the most important points connected with this subject; and how to improve our stock is a question of paramount importance.

The principles involved in developing and improving fine stock in the animal economy, hold with equal force in the vegetable kingdom. Hence, only plants having all the good points we desire to carry or to develop further, should be selected for our stock-beds, and if we see at any time a plant void of these, it should at once be pulled out and discarded.

Again, plants which have once fruited heavily should not be used for propagation, either for home beds or for market, as they have, of course, decreased vitality, and the use of such plants would ensure speedy degeneracy.

When some one point in an otherwise valuable variety is lacking, as for instance in the Jewell a disposition to throw runners freely, this characteristic may be greatly changed by marking those plants which are all right in this respect, and using only their progeny for stock plants. Some of our best fruit growers, among whom is T. T. Lyon, the respected President of the Michigan Horticultural Society, however, do not regard this trait as wholly objectionable, inasmuch as the tendency of a plant to concentrate Nature's powers on itself, rather than in profuse multiplication, lies right in the line of extreme fruitfulness. The Crescent and Haviland make runners too freely. But where slow propagation is manifestly a fault, it can be remedied by choosing plants of good vigor, struck as late as September or October, rather than heavier plants struck in July, which are crowded with fruit germs and hence have the preponderant tendency toward heavy fruitage rather than propagation. A plant that has the germs of two hundred berries is less fit for propagation than one that has fewer germs. I formerly made a mistake in sending out large plants, but I did it ignorantly. So where there is any lack in any habit of an otherwise valuable variety, it can in time be greatly modified by the judicious selection of plants for the stock-bed. To the lack of such care in the management of varieties, and to injudicious propagation, is to be charged the running out of varieties once highly esteemed. If we select weak runners indiscriminately for propagation we shall run down the character of the variety. The purchasing public are largely responsible for this, inasmuch as they will buy the most carelessly grown plants, at ruinously low rates, when at double the price they would secure carefully grown plants of high value. The same thing is true, to quite as great an extent, in regard to the propagation and sale of fruit-bearing nursery trees, which accounts for the very uneven and miserable orchards we see all about the country. We should prefer for trees the best seedlings from the best developed seeds before the feeble stocks from cider pomace, and they should be grafted at the collar, and the vicious practice of cutting up roots should be avoided.

You will excuse me if I allude to experience and observation somewhat, as I pass along.

A clergyman with decided horticultural tastes, said to me a few years since, "I raised a nice crop of beans on my land while getting it stocked with strawberry plants." You have often seen in the agricultural press, notices of similar import, how some one or other raised a fine crop of beets, spinach, peas or some other vegetable, and at the same time was stocking his ground with strawberry plants for the succeeding year. Of course I do not dispute that something of that kind can be done with a measure of success. With land of exceptional fertility it may be wise, but as a rule I doubt the wisdom of so doing. A crop of early peas may precede the setting of plants in July, provided that a new ploughing up is given, and there is no lack of fertility in the soil. We are never to forget that our strawberry crop is more than half raised the preceding year, and the question is pertinent, Which is better, a half crop of strawberries and a half crop of something else, or a full crop of berries? As an instance of high culture and its results, I will mention a case where three successive coverings of good manure were ploughed in on one acre and fourteen rods of land, and in July strawberry plants were set. When the berries were ripe many of them brought forty cents per quart, and the total receipts for the crop were $1,800. The secret of this success was that the land was full of manure and the best possible culture was given throughout.

The apostle's utterance, "This one thing I do," is a good motto for a given piece of land, for the time being.

Varieties and Their Management.— The varieties of strawberries offered to and planted by the public are numerous, and it would be beyond the limits of this paper to go much into detail in their description.

The Wilson was once every man's berry; the Crescent was called the lazy man's berry, possibly because — as was sometimes said — it would run outward and take care of itself, and perhaps there is some truth in that. The Haviland is with us much after the style of the Crescent. They are all rather too small to be satisfactory.

The Black Defiance, Hervey Davis, Gold, Henderson, and Wilder, are all claimants for high quality, but lack sufficient productiveness to be found largely in the market.

On our grounds the Middlefield, Sharpless, Bubach's No. 5, and Jewell, take the lead, the last two being specially adapted to hill-culture or the triple-row culture on rich soil.

For a soil of only moderate fertility the Crescent, Haviland, or Middlefield, would be better adapted, the others requiring richer soil and better culture. The law of adaptation has application here; you would not use a seventy-four pounder with only an ounce of powder, neither a pistol with a mammoth charge.

As a rule we have found pistillate varieties most productive when properly matched with suitable bi-sexuals, as we must have pollen for the best blooms if we wish to have perfect fruit. Thus three or four rows of the Jewell, with the Sharpless on one side and the Belmont on the other, we consider well matched. Likewise the Jersey Queen with the Cumberland on one side and the Charles Downing on the other have produced immensely. The Belmont is a valuable match for the Jewell, because it furnishes pollen even to the latest bloom.

I am strongly of the opinion that cross-fertilization for the Sharpless or any other bi-sexual variety is better than to depend on its own pollen, believing that plants, like animals, have a stronger affinity for a different strain of blood (so to speak,) from their own.

Production of New Varieties.— The fact that varieties do decline is a reason why we should make intelligent effort to produce new and better varieties. A few thoughts on this subject may not be out of place.

The mother variety from which the seed is taken should be a pistillate, chosen for its good points, with a good male parent in close proximity, in which case a true cross is well-nigh inevitable.

A more precise method of procedure in crossing varieties is the following which was a favorite plan with the venerable Seth Boyden of honored memory. Set four bi-sexual plants of a select variety in a small frame, thus: —

a		*a*
	x	
a		*a*

as at *a*, *a*, *a*, *a*, and in the center, *x*, set a well chosen plant of the desired pistillate variety for the mother plant. Let all these plants be forced to their highest development, especially the mother plant *x*. Just before the blooming season cover the frame with a sash to prevent insects from bringing foreign pollen.

Remove early from the plant *x*, all but three or four principal fruit stalks, so that the strength of its vital forces shall be concentrated in them.

As soon as the most important blooms on *x* open, remove the sash, and fertilize with pollen from *a*, *a*, *a*, *a*, using a camels' hair brush. It is better to fertilize in two or three successive operations, to ensure completeness of the work. Then replace the sash, which should be removed permanently as soon as the fruit is well set, two days after fertilization being sufficient. The finest of these cross-fertilized berries only should be used for seed. At perfect maturity mash the berries and wash out the chosen seed, place the seed on ice a few days, then sow in a box placed in a greenhouse or conservatory and when the plants attain sufficient size transplant to the open ground. These plants with good attention and culture will be large enough to stand the winter well, with suitable mulching, and will speedily be in bearing condition.

To all intelligent amateurs, to invalids, to ladies of horticultural tastes, and especially to youth of either sex, there is a fascination about this work, that is not only captivating, but also thoroughly elevating. As a recreation of absorbing interest, it is almost without a parallel. The possibility of a high degree of success, is sufficient inducement to encourage the undertaking.

The principles involved in choosing parent varieties are: first, to choose those having as many strong points as possible in common. Second, when the mother variety lacks in some one essential, select the male parent having that missing quality most fully. In short, aggregate in the prospective progeny as many strong points as are attainable. Of course we cannot sum up all the good points of both parents and *know* we have that aggregate, but possibilities lie in that direction. As already intimated specimen berries for seed should be the very largest, finest, and of ideal form and development; and yet the seeds from a single berry will produce a progeny of the widest variation, but in this variation lies the hope of improvement.

The momentum of high culture and favoring circumstances adds much to the possibilities for improvement in the new seedlings. I believe we can so combine the forces of two varieties as to get valuable results if properly handled. Circumstances of heredity will have effect; hence we cannot predict exactly what the final progeny will be. We want a Bartlett pear a month earlier than

we now have, and also a pear of fine quality ripening in March, and I think we shall obtain them; there is encouragement to make the attempt to gain them, in the fact that we need them. These are illustrations of the improvements which should be sought in raising new strawberries. Furthermore, I believe that new varieties as parents are more impressible — so to speak — than old varieties, and will engender changes more readily, and that cross-fertilization and environment will effect them more surely.

The points of importance in a new variety, are:

First, vigor, healthfulness, and large feeding capacity.

Second, a large flower, with a strong cone, whether pistillate or bi-sexual.

Third, great productiveness.

Fourth, good quality.

Fifth, good size, form, and color.

Sixth, sufficient firmness to keep well and ship well.

A variety with small leaves, and profuse in throwing runners, will usually produce small berries and stands a small chance of being retained.

A strong plant with a large, dark colored, leathery leaf throwing heavy runners, indicates a strong root-system and large fruit.

A light colored leaf is usually more tender and more subject to disease than a dark one.

All who raise strawberry seedlings will understand that the rejected plants will probably be largely in the majority. Many may properly be rejected while yet in the seed bed. Mr. Boyden said that as soon as the plant had three or four leaves he could select all that he wanted to retain for testing. The lot of seedlings comprising the Jewell numbered up to 500, but only a little more than 400 were retained to test. The more promising should be planted out in rows, staked, and numbered, so that notes can easily be taken at blooming and at fruiting from year to year if required.

Although we may have to reject ultimately 499 varieties out of 500, yet the possibility of that one choice variety will give zest to the most painstaking efforts in this direction. That the near future is to give us varieties of superior excellence, I have no doubt.

The Raspberry and the Blackberry.— With them as with the strawberry, the tendency is to over-crowding.

The land should be prepared as we have it for the strawberry; the more manure the better. Plant strong plants of the raspberry six feet by six feet; the blackberry eight feet by six feet.

When the canes reach three and one-half feet, nip off the tips; this will give strong laterals, and when those reach one and a half feet, clip them. Such plants so treated should yield an enormous crop of large berries. Few are aware of the possibilities of such plants.

Every farmer, laborer, mechanic, artisan, or professional man, may have these summer fruits in great abundance. They not only afford a rich luxury for the table, but the sanitary effect of such fruits is too important to be overlooked. We hope the time is not far distant when every household may realize the advantage of an ample home garden abounding with choice vegetables, fruits, and flowers.

We are fully aware of the abiding interest this Society takes in encouraging efforts to produce new and valuable varieties. This is in harmony with the progressive age in which we live. Progress in every other department of industry is surely made. Horticulture, Floriculture, and Pomology should in no wise be behind.

The Massachusetts Horticultural Society has a record of which it may justly feel proud, being recognized, the world over, as in the front rank of intelligent, progressive effort. We feel assured that the future of this Society will be in full accord with the past, and that the younger members, and those who shall from time to time be elected to so honored a membership, will strive faithfully to keep up the high standard so well sustained by their seniors, and by those well remembered pioneers who have gone before.

Discussion.

William D. Philbrick called attention to Mr. Augur's directions as to a closed frame of plants for hybridization, and asked how the frame was to be ventilated during the period of fertilization.

Mr. Augur replied that if the plants were protected from pollen-laden insects from the time the flowers were ready to open, and until the third day after the hand-fertilization was completed, the seed could not be affected by any other pollen. The frame could be protected from insect intruders by a gauze covering during that period, if it was necessary to lift the sash meantime for ventilation.

Rev. Calvin Terry asked for information about a prize bed of Jewell strawberries, grown by Mr. Augur.

Mr. Augur stated that one twenty-eighth of an acre of land was prepared as recommended in the essay, and planted to the Jewell strawberry, with occasional rows of Sharpless, Charles Downing, and other bi-sexual varieties to fertilize them. A committee from New York visited the grounds in June, when they requested that a record of the plat be kept for subsequent reference. The crop gathered averaged over one quart to each plant and there was not a plant missing from the entire plat at that time, a reserve bed, from which a few plants were drawn to fill vacancies, having been kept. No difference was observed in the fruit to indicate that fertilization was due to different bi-sexual varieties. The fruit measured was gathered from only the Jewell plants.

Mr. Augur spoke a word of caution against planting strawberries in grass land just broken up, as it is apt to be infested with the larvæ of the May beetle. He once ploughed up a piece of grass land and planted it with strawberries, so many of which were destroyed by the May beetle that the whole bed was ploughed up. He likes to have grass land broken up two years before planting the strawberries.

S. H. Warren asked if the lecturer thought it as important, as most writers state, that staminate varieties must be set near pistillate kinds, in order to have the latter produce perfect fruit. He said he had cultivated strawberries thirty-five years, and had picked very nearly perfect fruit from Jewell plants (pistillate) in October, where there had been no staminate variety in bloom anywhere around so far as his knowledge extended.

Mr. Augur said that no variety of strawberry produces flowers absolutely destitute of stamens. He has had a plat of Jewell plants left over, which gave many berries, but they were imperfect; also, some years the Crescent has yielded quite a crop alone. But we must not presume to depend upon self-pollenizing in pistillate varieties. He desired to add a word on the utility of bees and other insects in pollenizing the flowers of strawberries and other fruits. He stated that by a wise provision of Nature, at the time the pollen-grains ripen, a saccharine substance exudes within the flower and attracts the insects which, while busily gathering sweets, are unconsciously made the agents for the more complete pollenization of the pistils which otherwise might remain undeveloped.

Mr. Warren had found that the Jewell requires more water than any other variety, and that when grown on land moister than the average garden soil it throws out plenty of runners. He asked the lecturer if he took but one crop of fruit from one setting of plants.

Mr. Augur replied that time is money, and he was very decided that it requires too much time and labor to weed an old bed; besides, the second crop is always much inferior to the first. Therefore, it does not pay. He preferred to alternate with other crops.

Mr. Warren asked whether planting in hills is preferable to planting in beds.

Mr. Augur thought he had better success as respects the fruit when he planted in hills than in matted beds. In the first case he got more and better fruit; in the second he got some fruit, but many more new plants, for which he has always a large demand.

E. W. Wood remarked that we have had this lecture to teach us about the varieties of the strawberry, and the theories and best methods of practice in its propagation and culture. The essayist had given us so much to think about, that others see no necessity for talking. He is one who has done more than any other person to develop this fruit, and show its capabilities. We notice that most varieties do not long continue to be generally grown. Many that were very popular not long ago are not now seen on our exhibition tables; in fact during the last ten years almost every old variety has disappeared. The speaker did not know where to go now to find any plants of La Constante, Wilder, or Hervey Davis, although some were shown here less than two years ago. Taking the experience of the past as a guide, it would appear that we must depend upon new seedlings for renewal of our plants. How many will carefully carry out the methods Mr. Augur has described to us today? We want an earlier kind than May King if possible, and larger also. The new strawberry producers have been concentrating their efforts on the increase of size regardless of quality. The market demands the largest and best looking fruit; consequently this is sold at the highest price, while medium and smaller varieties have to be sold at about half price, although they are of a far better quality and more productive. While they are not profitable for the market, they are preferable for the home garden, as they produce enough for the amateur.

Mr. Augur's mode of growing plants for fruit is correct for him, but few large growers would cultivate them in that form. The Sharpless or Belmont would give enough work to keep off their numerous runners. The Belmont is quite productive of fruit even when grown pretty thick. The only objection to the Jewell is that it does not produce runners freely; but it is the most prolific in fruit, and it is best grown in beds. We have thought the growers at Belmont, manured pretty freely when using twenty-five cords to the acre for three crops, but the speaker took a long breath when the lecturer told of using forty cords to the acre. He spoke of an Arlington market-gardener having 24,000 feet of land, on which he set strawberry plants in rows five feet apart and eighteen inches apart in the row. Egyptian beets were then set fourteen inches apart as an extra crop and the gardener claimed that he got as many strawberries as if no beets had been growing there. The next year his crop of strawberries brought $800, and he also received $86 in prizes. The speaker thought the matted row system of planting strawberries the best.

Mr. Warren inquired if the plants wintered as well in hills, or in beds where the runners have been cut off, as they did in matted rows. His own opinion was that the plants in the first two cases were more likely to be thrown out of the ground by frost, but in the matted beds they were not so much exposed.

Mr. Augur answered that he likes to cover the plants pretty well during the winter, and uses from two to three tons of coarse hay per acre for that purpose. The plants do not suffer at all when thus protected, while plants exposed are more or less injured by alternate freezing and thawing. He stated further that he accepted Mr. Wood's idea of matted rows, provided they are not allowed to become too much matted. With any variety he would set the plants three feet apart, which would allow sufficient room for all needed new plants. This seems to call for a great deal of work, in preparing the ground, but that is done rapidly.

O. B. Hadwen said that he had been very much interested in all he had heard at this meeting. Mr. Augur has shown us how he cultivates strawberries, and what the best culture produces. Mr. Wood has told us of the liberal use of manure, from twenty-five to forty cords per acre, and that the latter figure seems an extraordinary amount. He could tell of an experience far exceeding that. A gentleman in Connecticut, who is able to do as he

pleases, told him that he used one hundred cords of manure per acre, for strawberries, and in addition had applied liquid dressing which was obtained by leaching a quantity of other manure. The effect of such treatment was astonishing. Plants set in August had made such a growth by the end of September, that a half bushel measure could not be put over one of them. Similar treatment was applied to melons and other crops with equally surprising results. Mr. Hadwen also spoke of the longevity of varieties of the strawberry, saying that with the exception of our native and the Alpine strawberry, all those he knew in his boyhood are now lost to sight. Perhaps Hovey's Seedling had the longest life of any cultivated variety—about forty years. The type of this berry changed in form both of leaf and fruit, even in Mr. Hovey's own grounds. In 1840 the price of Hovey's Seedling plants was twenty-five cents each. The Wilson held out only thirty years, and most others have had but a short career. The essayist had a great opportunity and knowing very well how to improve it, had accomplished a valuable service to all growers of this fruit. The speaker was convinced that we must depend on new seedlings for future use.

Hon. Aaron Low being called upon said that many of the lecturer's points agreed with his own experience. He bought Belmont plants and set them on clay ground, and planted Jewells alongside to grow runners. The Belmont made many runners and the bed was the handsomest of that variety he ever saw, but many of the berries were imperfect. The Jewell plants were a great success, but he thought a cross produced from Jewell and Belmont would be very desirable. He believed Mr. Augur's theories about cross-fertilization for new varieties are correct, but that a great deal of experience is needed before one can expect much success in such operations. He was convinced that after a flower has been fertilized by hand, bees cannot affect it very much. In regard to producing new varieties of potatoes, he believed it could be done only by planting the natural seed balls, as that is the way Nature multiplies varieties in vegetables. The tuber of a potato is *not* the seed, although the variety can be propagated by the eyes of the tuber as it can by cuttings of the green stalk, as many other kinds of plants can be multiplied. New varieties must be produced by cross-fertilization of the flowers, and planting the seed produced from those flowers. As there will be great

variation in the general characteristics of the seedlings thus obtained, the operator should select such as show the greatest development of the essential points desired in the new varieties to be brought out. From these, by careful selection and training for a few years, the much desired new variety, superior to all others will be established, and by continually using the best specimens as seed-stock, it can be maintained pure, avoiding the natural tendency to go back to the form of one or the other parent. In producing new varieties of corn there is but little trouble, the fertilizing pollen is so readily carried by the wind and falls upon the silk of different varieties. Thus crosses are being made continually from the kinds planted near each other. But to permanently establish any desired point in quality or character requires years of careful experiment, training and watchfulness, as all such crosses have a natural tendency to "sport," and if not grown at a long distance from all other varieties, they are liable to accidental cross-fertilization.

Mr. Augur desired to state in regard to heavily manuring land, that he had never put forty cords of such manure as he recommended upon one acre, but it was only because he could not get it.

Mr. Warren stated that he had invented a machine for cutting off strawberry runners. It consists of an iron finger which passes under the runners, and a circular knife — worked by the wheel on which the machine is carried — which cuts off the runners as fast as they are gathered up by the finger and as fast as a man would walk. It is to be used after the runners have generally struck roots, but he had not used it very much of late as he thought the plants did not winter as well if so cut just before the colder season came on.

On motion of Mr. Hadwen, a vote of thanks to the essayist for his interesting and instructive paper, was unanimously passed.

The announcement for the next Saturday was a lecture upon "The Geographical Distribution of Plants," by W. F. Ganong, Instructor in Botany, Harvard University, Cambridge.

BUSINESS MEETING.

SATURDAY, February 21, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

The following report was presented and accepted:

The various Committees have voted to postpone the Exhibition of March 25, 26, and 27, to March 31, and April 1, 2, and 3, as the first-named dates occur in the week preceding Easter, when plants and flowers will be scarce.

PATRICK NORTON,
E. W. WOOD,
F. L. HARRIS,
C. N. BRACKETT,
ARTHUR H. FEWKES,
JOHN G. BARKER.

Horticultural Hall, Boston.
February 14, 1891.

Adjourned to Saturday, February 28.

MEETING FOR DISCUSSION.

THE GEOGRAPHICAL DISTRIBUTION OF PLANTS.

By W. F. GANONG, Instructor in Botany, Harvard University, Cambridge.

The subject I am to present to you this morning, as you may perceive from its title, is not horticultural. A Botanist trained in the methods of scientific Botany today, does not necessarily know much, or anything, of those practical details so essential to the successful pursuit of the most delightful of avocations—that which is the province and pleasure of the members of this Society. Yet Horticulture ought to be, and is, a broadening study, and I am sure that a short excursion into fields of more abstract science will have more than a passing interest for you.

Certainly the field to which I invite you is broad enough and scientific enough, being no less in extent than the earth's whole surface, and the laws which govern the position upon it of every

living plant. I fear, should we attempt to cover in detail so great a territory that we should not have ranged very far before all of my allotted time and your patience would be exhausted; and we shall therefore do well to concentrate our energies upon the characteristics of its salient points.

It is undoubtedly the case, that the point of view from which the Horticulturist regards the Plant, is very different from that of the professional Botanist. For the former, the plant has its highest interest in its adaptability, actual and possible, to the necessities and enjoyments, both bodily and mental, of mankind; and its susceptibility to indefinite improvement along these lines is one of its greatest charms. But to the scientific or philosophical naturalist, the plant is more of an abstraction. It chiefly interests him for what it represents of natural laws and phenomena. He regards it as a being, filling a most important place in nature by virtue of its very perfect adaptability to the conditions of that place, and each of its parts exists for a similar reason. The root is an organ for the absorption of liquids from the soil, the leaf for the manufacture of organic from inorganic materials, and the stem to bring these two into proper relationships with each other and with their surroundings. The flower is but a highly-perfected device for securing the co-operation of two parents in the production of offspring; the fruit is the agency by which is secured the necessary ripening and wide scattering of the seed, and the seed itself is but a specialization of the plant structure for holding the life of the species for a time in suspension, so to speak, to enable it to continue existence over certain unfavorable periods. And these organs have their immense variety of forms simply to fit them better to perform these functions, under the different conditions to which they are subjected. That they are useful to man, or that they have beauty to delight us, is, from this point of view, but incidental; and is either but the happy coincidence of our own needs and tastes with what is best for the plant, or else the result of the gradual adaptation in times past of our own needs and tastes to what there is in nature best adapted to supply or gratify them. The plant is the creation of its ancestry and its surroundings, and represents the resultant of innumerable influences acting upon it from these two sources. The plant, indeed, from the scientific point of view, represents the meeting point, or focus of an infinite number of forces or influences acting upon it from varying directions and with varying intensity,

and this focus or resultant is to the forces very much what its centre of gravity is to a complexly irregular body. It represents a most delicately adjusted balance of conditions—a state of unstable equilibrium, which may be altered by the slightest change in any one of the forces; and the plant must become something different just in proportion to the intensity of the change. These influences are none the less real because so minute, and their study is the study of plant life. To complete our conception of this kind of study, it must be added that the scientific botanist believes, in his working hours at least, in the uniform immutability of those series of concatenations of events which we call the laws of Nature; and moreover, leaving the unknowable for the use of the metaphysician, he acts upon the belief that all things in nature *are* knowable, can we but sufficiently refine our methods of investigation.

Now the point of these observations lies in the application thereof to our present subject. Each and every plant has its place on the earth's face fixed by a tremendously complex set of influences, some strong, some weak; some acting through heredity, some from environment; some from this, some from that; the end and result of all of them being to make the plant just what it is, and to place it just where it is; and any change in any of these influences will disturb the balance, move the focus, and cause a corresponding change in the plant, which will vary directly as the influence. And in this brief survey of the field we can but consider the broader pencils or groups of forces determining the geographical distribution of plants, taking time to resolve none of them into lesser groups, much less into smaller details.

The great controlling or limiting physical agencies in distribution then are these:

I. Heat and moisture, or in other words, climate.

II. The past geological history of places.

And this is true not only of great areas, but as well of the most limited, and there is not a square mile of land in New England which will not furnish illustrations of this principle. The main cause which confines the Cactus to the desert and the great Aroids to the damp forests, is the same, but in lesser degree, which places on our dryest knolls our Saxifrage and Everlasting, and in our marshy pools our Iris and Calla. It is but the same cause in different degree which allows the low Arctic herbs to exist upon the Himalaya, and the white Potentilla upon our own most exposed and coldest

shores. And the extremes of these conditions are represented on the one hand by the frigid barrenness of the Arctic zone, and on the other by the rank luxuriance of the Middle Tropics, and there is every gradation between. It is true that other influences are at work also,—prevailing character of the soil, abundance and kind of enemies, etc., but heat and moisture are undoubtedly the most important of all those which belong to the physical surroundings.

Now the distribution of heat over the earth's surface is determined by several conditions, amongst which the most important are these:

(1) Other things being equal, the greatest quantity of heat is received from the sun by the earth at the equator, and the amount diminishes regularly towards the poles, the whole being subject to regular variations owing to the movement of the earth placing the the sun alternately north and south of the equator. It is plain that, were it not for the disturbing effects to be mentioned below, the earth would be divided into great latitudinal zones of temperature of uniform breadth, to which vegetation would tend to correspond, and our problem from this point of view would be greatly simplified.

But (2) the relative distribution of land and water powerfully affects these zones. This includes the influence of cold and warm currents, whose effects are marked enough. Everybody knows how the Gulf Stream raises the mean annual temperature of Northwestern Europe, or how the great Japanese current raises that of British Columbia and Alaska. And on the contrary we are very sensible ourselves of the way in which the cold Labrador current keeps our mean annual temperature reduced below that to which our latitude entitles us. Again the principle that great masses of water are equalizers of temperature, and that great masses of land permit of extremes, is one of much importance; and abundant illustration will occur to all in the case of the extreme range of temperature to which the cities of the central states are subjected as compared with the much smaller range of the mercury in the seaport towns.* And its importance becomes still more manifest when we compare the well-known evenness of the temperature range of oceanic islands, with the conditions prevailing at Yakutsk in Siberia, which lies well within the greatest body of land in the world

*The climate of Boston does not afford a fair illustration. It is so near the Cape Cod Peninsula, which is the great natural boundary between the colder northern and warmer southern waters, that it is exposed to a set of very unusual conditions.

and which has the greatest extremes of temperature of any place in which observations of this kind have been made.

(3) The height of land above the sea-level always causes, *ceteris paribus*, a direct variation in temperature, this falling as the height increases, and of course rising as the height diminishes. From this cause it happens that we find upon high mountains, a series of stages in the vegetation, the characters of which indicate successively colder and colder zones. And usually, as all botanists know, the vegetation of these successive zones of altitude corresponds closely to the vegetation of those places farther north, which at or near the sea level have the same mean of temperature; in other words we have zones of altitude corresponding very exactly to zones of latitude, and wherever the late geological history of a region has permitted of it, the vegetation of these two kinds of zones corresponds not only in general characteristics, but is composed of identically the same genera and species. Hence it is that we find arctic plants upon the Alps and Rockies, sub-alpine plants upon the White mountains, and Antarctic plants upon the Andes — a subject soon to be referred to again.

The influence of the first of these conditions, must be prodigiously altered by the second and third, and the effect will be to make the zones of temperature extremely irregular. Humboldt invented a very simple method of graphically representing the boundary lines of these zones; that of drawing upon a map isotherms or isothermal lines; and any map upon which these are drawn will show very clearly the effect of the second and third of the conditions mentioned upon the first. And it is important to notice that all of these conditions operate as well upon a small as upon a large scale, though in diminished degree, and therefore distinguishable with more difficulty.

It is necessary to note, in connection with this subject of temperature, that the whole matter is complicated somewhat by the fact that the distribution of plants depends quite as much upon the average temperature of the growing and reproducing months as upon the average annual temperature—perhaps, indeed, a good deal more. This serves to explain those cases in which grains will thrive in regions very far north of where, from their mean annual temperature, we should expect; this seems to occur wherever the actual average temperature of the actual growing time is high, even though that of the remainder of the year is disproportionately low, as

happens in parts of northwestern Europe and of the Canadian northwest.

The distribution of moisture depends of course chiefly upon rainfall, which in turn depends upon meteorological conditions of which the discussion is not in place here. It is enough for our present purpose to note that in general the tropics have the greatest rainfall and that there it is extremely regular. All readers of Mr. Wallace's remarkable book, "Tropical Nature," will remember his most graphic account of tropical rains and their effect upon tropical vegetation. With an abundance of evenly distributed solar heat and an abundance of evenly distributed moisture, it is no wonder that tropical forests are so luxuriant. Just outside of the tropics comes a great rainless belt which includes nearly all of the desert regions of the earth, and beyond this again, both north and south of the equator, we come to the regions of variable rainfall, with which purely local conditions have so much to do, and passing which we come to true Arctic conditions. Amongst the important local causes influencing rainfall in the temperate regions are the proximity of the sea, direction of the prevailing winds, and the presence or absence of mountain ranges. The latter always tend to cause precipitation on themselves, and between themselves and the sea, and to shut off from the blessings of the rain the region on the side away from the sea. It is, for instance, owing to the presence of the Sierra Nevada and Cascade ranges that the region to the west has so much more abundant a rainfall than has the region on the east of them. Upon this side of the continent, the Alleghanies are not high enough to produce more than a partial effect in this direction.

And secondly among the controlling agencies in distribution comes the geological history of plants: geological history in this connection means simply the story of the changes in the distribution of land and water in past times as compared with the present—and the consequent migrations plants have been forced to make, not always into regions the most favorable to them. Hence it has come to pass that plants today are not all placed on the earth's surface just where the conditions are most favorable to them, and many of them when introduced into new lands, often find there conditions more congenial than in their old homes. But geological history is of more importance as a distributing agency, and we shall in a few moments consider it in that connection.

Now these two, I must ask you to notice again, are the limiting

or controlling agencies; they are not the distributing agencies. And they are the controlling agencies for this reason: every species of plant, without exception, has certain definite maximum and minimum points both of temperature and moisture within the range of which it can live, outside of which it must perish; and moreover each has within those limits a certain optimum point of temperature and optimum quantity of moisture at which it flourishes best, and each plant, other things being equal, could flourish anywhere on the earth's surface where these best conditions are realized, were the field open for it and *could it but get there.* But that is the great if; plants have comparatively very small powers of travelling themselves, and geological history, with its forced migrations, has driven them into the regions where we find them and kept them out of others to which they are equally well fitted. You can understand better now what I meant at the beginning when I said that a plant is the creation of its history and its surroundings, and that these have operated to make it just what it is and to place it just where it is. And I trust you will understand it still better before I shall have finished this lecture.

These being the limiting agencies, we are now prepared to look at the distributing agencies and to note what effects have been produced on vegetation by their combined action. These distributing agencies are three:—

I. Natural methods of dissemination.

II. Influence of man, direct and indirect.

III. Geological changes — the changes which have in past times compelled groups of plants to migrate from place to place.

The first and second of these deal chiefly with single species, and are therefore of less significance. The third has to do with great masses of species historically connected, or Floræ.

The subject of the natural dissemination or scattering of seeds is one of the most interesting topics in botany, and I am sure a presentation of it would prove of great interest to you.

Plants have developed the most remarkable devises to secure a wide scattering for their seeds. But their bearing upon our present subject is limited by the fact that these devices are rarely adapted to carry the species beyond a limited distance, and very rarely indeed are they of a character to enable the plant to surmount the natural barriers imposed by mountain ranges or wide seas. Of the exceptions one of the most important is found in the coconut. This fruit has a thick but very light coating, which is unusually

resistant to the action of salt water. The palm which bears it frequents the sea margin, and the fruits falling into the water are carried immense distances by the action of winds and currents. Hence the coco palm is one of the first plants to appear upon coral islands, and it has even been said to be the only palm tree common to both hemispheres. Again, there are certain species of which the seeds or fruits have developed plumes or tufts of fine hairs which make the total bulk of the seed or fruit very large in proportion to its weight, thus enabling the wind to carry it very long distances. Such is the case with many Compositæ, as for instance the dandelion, the plumose fruit of which is known to everybody. This can be carried by the wind for hundreds of miles, and hence is widely scattered over North America and Europe, and very probably much beyond these limits. And many other instances of a like character could be cited. A most interesting and important branch of this inquiry is concerned with the natural return of plants to localities from which climatic changes have driven them. Thus the glacial ice-sheet drove all plants before it to the South, but when it in turn retreated back to its home in the frozen North, these plants tended to follow it and re-occupy their old haunts. Now there is every reason to believe that those plants having methods of rapid dissemination and therefore an advantage over their less fortunate relatives, travelled more quickly and occupied the ground, and that the slower moving forms are still with difficulty making their way back whence they came. This seems to be well illustrated by the trees. The forms which have light-winged seeds easily scattered by the wind, such as birches and willows, extend very far north, and the same is true in lesser degree of the elms and maples. But the heavy seeded trees like beeches, oaks, chestnuts, etc., are not so far advanced as their constitutions will allow, and they are slowly but steadily moving north, a point which is well argued by Professor Shaler of Cambridge. And the extremely different rate of the natural spread in this way of the various species, when a new land connection is formed with another district, must be taken into account in all these studies.

Another method of securing dissemination, of wide prevalence and effectiveness, is found in those fruits which by bright colors are made conspicuous, and by juicy pulp palatable to birds or animals—a very large class, including nearly all of our edible fruits. In such cases the seeds are swallowed with the fruit and being provided

usually with indigestible coatings are carried long distances, ofttimes, before they are left by their carriers. The widest distribution by this agency is undoubtedly secured through the birds, for birds can cover a much greater area within a limited time after a meal than can animals, and moreover they can pass readily over those natural barriers — hill ranges and smaller arms of the sea — which animals cannot. But we must not over-estimate the importance of this agency, for birds of the longest flight are generally carnivorous, and can only occasionally and accidentally get some seeds into their crops when other birds are their prey. Still a wide dissemination of certain species is secured in this way, and some of our edible berries are good examples. Those seeds which cling to the hair or wool of animals also secure some scattering in this way, but it is limited, as mammals do not as a rule range as far as birds. There is one peculiar case, however, in which a certain very modest species is believed to be the most widely distributed in the world (for modesty is no bar to success in the vegetable kingdom), and this has been brought about by the agency of birds. That is the case of our very common water-shield, *Brasenia peltata*, which is scattered widely not only in North America, but is found also in ponds in Asia, Africa, and Australia. As the species has not an edible fruit, it is supposed that the very sticky fruits cling to the feet of aquatic birds and are hence carried over greater distances than would be possible in the case of edible fruits of the ordinary kinds. In all of these cases of course the distribution is ultimately limited by the purely physical conditions of which we have spoken, and the competition from the forms already occupying the ground to which the new seed is carried.

The next great influence that we must consider is that of man. Man is always prone to over-estimate his own importance, and this applies with particular emphasis to his relation to the remainder of Organic Nature. His influence upon the Plant Kingdom has been far less than appears at first sight, and almost uniformly unfavorable, and it is a fact that the remainder of the world would get along better if he were to drop out of it altogether. We have to a slight extent altered nature; I doubt if we have improved it.

The direct influence of man in carrying plants from place to place will occur to you first. But this includes for the most part forms cultivated for food or for ornament, and the majority of them, if left to themselves in their new homes would soon be

exterminated, and hence produce no lasting effect upon plant distribution. Such is the case with grains and most European garden flowers introduced into this country, which rapidly die out as soon as cultivation ceases. Cultivation largely consists in keeping away from a plant its natural enemies; and most plants when carried to a new home cannot, unaided, compete with the native forms, whose constitutions have been acclimatized by centuries of residence. Hence the transfer from place to place by man, however extensive it may be, of plants which could not exist in the new region without his constant care, has but little to do with our present subject. But there are some plants which he transfers, generally unintentionally, which often find in their new homes conditions favorable to their rapid growth and spread; and they frequently make themselves at home to such an extent that they become great nuisances. Such are most of our weeds. As is well known, nearly every troublesome weed in our own regions, for instance, has been introduced either from Europe or from the open lands of the West. The reason for this appears to lie in the direction pointed out by our greatest botanical philosopher, the late Asa Gray. The native weeds are all forms which have developed in or with the woods, and when the latter were removed in the processes of cultivation, they found conditions to which they were unaccustomed and for which their constitutions were but poorly fitted. The European accidentally introduced forms, however, after their centuries of struggle with European civilization, hardy and self-reliant as our own street urchins, found here a field not only just such as they were adapted to, but occupied by no forms which could offer them vigorous competition. Hence, they multiplied and occupied the earth. In a lesser degree the conditions were favorable to plants from the west accustomed to open ground. It is along these lines that man has produced his greatest effects upon plant distribution. You notice that we are considering now the question from the Naturalist's stand-point, not from the Horticulturist's. To the latter the transfer of Cinchona from South America to India, of Eucalyptus from Australia to California, of the Maize to Europe and China, is a large matter in comparison with his accidental transfer of a few troublesome or ugly weeds from the old world to the new; but to the naturalist the question of the weeds is of as much if not more interest and importance,—certainly it is to the organic world which the naturalist ought honestly to study.

In fact, the cases in which man has produced any considerable effect upon the vegetation or flora of a region are extremely few, and the effect is nearly always destructive. He often clears away an entire forest leaving in its place hideous, naked barrenness, but where has he made a wilderness to blossom as the rose,—with wild plants which could sustain themselves after his watchful care is removed? The Island of St. Helena is a case in point, in which by the combined action of the axe and of introduced browsing animals, principally goats, a rich vegetation, peculiar to that island, has been nearly exterminated from off the face of the earth.

And now we approach that part of our subject which I am sure will prove the most interesting to you,—the distribution of the great floras of the earth. A flora is simply a great group of plants which have had a common history. There is no fact better established in geology than that the earth's crust is not stable but is constantly undergoing extensive elevations and subsidences; this brings it to pass that land and water surfaces are not constant but changing, and that many regions now separated by the sea have in former times been connected, and many now connected have but lately become so. These changes have forced vegetation to perform migrations which have been small or extensive, slow or rapid, just in proportion to the change, and these have been accompanied by great changes in climate, including even such extreme conditions as prevailed in the glacial period.

In looking at the Distribution of Plants in a broad way, the first feature to strike attention is the constancy with which upon higher mountains we find plants characteristic of regions far to the north of them in the northern hemisphere, and far to the south of them in the southern—and in all cases cut off from their brethren by many valleys and plains occupied by totally distinct species. Thus, upon the Rocky Mountains, the Alps, the Himalayas, and others, are little herbaceous plants which are found growing at the sea level around the Arctic ocean. Farther down these mountains come plants which grow in more southern parts of Alaska, Labrador, northern Scandinavia, and Siberia. Now it is plain why they can live there—the conditions of heat and moisture upon the mountain side and at the sea level farther north, are similar, as we have seen; but how did the plants get upon the mountains from the North? The natural means of spread of

the species themselves is hardly ever sufficient to explain this. But the solution is undoubtedly found in late geological history. In the glacial period, geologically very late, as you know, there descended from the north a great ice sheet of enormous thickness, which drove all vegetation before it. It came so far down that Arctic plants were driven to the south of the region in which we are now living and arctic plants flourished all across the United States just south of a line from about 40° north latitude on the Atlantic coast, running diagonally north-westward, and in corresponding regions in the eastern hemisphere. Along the high mountain ranges these plants extended much farther south, finding upon them their natural conditions of heat and moisture. Then the ice-sheet retreated; the arctic plants followed it, and they in turn were followed by the north temperate,—they by the warm temperate, and so on, each tending to return to its own latitudes. But along the high mountains the conditions did not change much, and the arctic plants found upon them, as they find today, congenial homes, where the species of the lowlands could not compete with them. In the valleys, however, the more southern species were more at home and soon drove out the arctic intruders. So wide-spread and definite was this agency that there has not been a mountain range explored in the northern hemisphere upon which traces of these arctic plants have not been found; moreover, the lower ranges, those, like our own White Mountains, not high enough to reach the line of perpetual snow, have not the extreme arctic forms upon their tops, but sub-arctic or very cold temperate forms, and these extend south along the hill ranges, ascending as they go. A very interesting point in connection with this is the fact that in the glacial period some of the arctic and sub-arctic forms managed to cross the equator along the highest mountain chains of the old and new world and establish themselves in the southern hemisphere, and are there found on the mountains at the present day. Hence we have a great natural group of plants called the *Arctic-alpine Flora*, consisting chiefly of low herbs, the distribution of which is all around the northern part of the northern hemisphere upon the shores of the Arctic ocean, and southward upon nearly all mountains high enough to reach the limit of perpetual snow, and even extending sparingly on the great ranges into the southern hemisphere, at length reaching the sea level near the Antarctic ocean.

Secondly, in the Southern hemisphere, we have a very similar, though much less abundant *Antarctic-alpine Flora*, which is found near the sea level on the islands of the southern ocean, and extends northward upon the mountains of Chili, Australia, Tasmania, and New Zealand, and even up to Borneo. The phenomena of distribution of this Flora are so similar to what is found in the Northern hemisphere that it is believed its distribution can be best explained by a southern glacial period.

Proceeding next to Temperate regions, we find a most marked contrast between the northern and southern hemispheres. In the former we find the plants, the ordinary trees, shrubs, and herbs which we all know, all across Europe, Asia, and America, are much alike in character, and the differences between the plants of different regions is rather one of relative richness or poverty in forms than of differences in the forms themselves,—a point which I will refer to again immediately. Hence, with the exception of a specially rich assemblage in the Caucasian and Western Mediteranean region, all the plants of the northern temperate zone are grouped into one Flora called the *Intermediate* or *Temperate Flora*, and the rich exception of which I speak is appropriately called the *Mediterraneo-Caucasian Flora*. This latter is exceedingly rich in species, six-sevenths of those of Europe belonging to it. Now the uniformity of this Northern Temperate Flora is very fully explained by what is known of its history. Around the Arctic ocean, at several points, in Greenland, Spitzbergen, Siberia, and other places, there are found abundant fossil deposits of plants in Tertiary rocks, which fossils are undoubtedly the remains of the ancestors of our living north temperate vegetation. Not only are the species of fossil and living forms very similar, but in many cases they appear to be identical. Our North Temperate Flora then, in the Tertiary Period, lived and flourished all around the Arctic circle and within it, and probably extended to the pole itself. Then great climatic changes drove it southward, and it peopled all Europe, Asia, and America with a similar flora. This was subsequently driven to the south by the Glacial period, as we have noticed, and in the changes attendant upon that process and its return northward, parts of it suffered severely. Thus, in Europe, this flora is for the most part a poor one, having far fewer species than our own. This is explained doubtless by the fact that in Europe the mountain ranges run east and west,

and as the glacial sheet advanced southward, the plants of central Europe were caught between it and the increasing local glaciers from the Pyrenees, Alps, Apennines, and Caucasus; there being little chance for escape many of the forms were exterminated, particularly those not having natural means of wide dissemination. And many of those which escaped the icy jaws of the glaciers were pushed across the Mediterranean. This they were unable to recross when the glacial ice-sheet retreated, and but few of the exiled forms could return to their homes again. That this was the true course of events is rendered nearly certain by the fact that these missing forms are found fossil in late deposits in central Europe, showing that they existed there anterior to the Glacial epoch. Central Asia has to some extent suffered in a similar way, and Greenland has its flora swept off into the deep sea, and it has not now the plants to which the climate of its southern part entitles it. But the conditions were very different in eastern America, and in eastern Asia. Here the mountain ranges run north and south, or nearly so, and in Asia the great ranges end before they reach the sea. Thus a free passage was open along which the plants travelled south out of harm's way, and north again when the enemy had retreated. Hence the floras of eastern America and eastern Asia are both exceedingly rich in species and most strikingly alike, each having preserved nearly all of its species through the vicissitudes of glacial times.

But why is not the flora of western America rich and like that of eastern America? This question is not so easy to answer. It is true the Rockies run north and south; why were not all the western plants preserved? Several causes have doubtless contributed to destroy them, one of which is the extreme narrowness of the region west of the great mountains, and, hence, the crowding and extermination of some species, and another the fact that the very uniform climate of California is not so favorable to the northern species, accustomed to more variable conditions, as it is to the more southern forms of Mexico; and these latter have travelled in large numbers into California and possibly by direct competition have exterminated some species. Certain other geological conditions have doubtless contributed somewhat to the same end. But the fact remains that like that of Europe, the flora of the Californian region is poor in temperate species, while those of eastern America and Japan are rich and much alike.

In the southern hemisphere, we find a very different state of things. There the great continents, separate from each other from a most remote period, possess floras strikingly distinct from each other, so that it is necessary to assign to each great body of land its own distinct Flora. This gives us

The *Australian Flora*, showing some slight traces of connection with the region to the north of it and with New Zealand. Australia has been so long separated from the other bodies of land, that its flora has had time for a great deviation from that of other countries. Indeed it is notorious for its unlikeness to that of any other country.

Next the *Andean Flora*, that of South America, which shows some very slight connection with that of New Zealand and Australia.

Then the *Mexico-Californian*, which extends up the west coast of America from Chili to Mexico and even into California, being the source of many of our present Californian species.

Lastly the *South African* is very rich in species and remarkably varied. And just as our North Temperate plants have representatives far south of them on the mountains, so these Southern Floras have some of their members on mountains away to the North. "The plants of Fuegia extend northward along the Andes, ascending as they advance. Australian genera reappear in Borneo and even cross to China and Japan. New Zealand forms are on the mountains of New Caledonia; South African in the Lake Region of Africa, in North Africa, and even to the Canaries and Asia Minor." And in all these cases, the southern, like the northern, forms ascend the mountains as they approach the equator, and descend toward the sea level after they have crossed it.

Now what is the history of these widely separated regions? There seems every probability that in times far back all these floras came, not from the south but from the north; and the time when they had a common home there is so remote that the floras have had time to diverge greatly. That this is the correct view is sustained by the fact that these southern floras are much more like those immediately to the north of them than they are like one another; that there is no evidence of a southern continent from which they could have come; that while most peculiar species of the South have relatives either living or fossil in the North none of the northern forms have fossil relations in the South.

Lastly come the tropical floras, characterized by great abundance of all kinds of vegetation and with a preponderance of succulent moisture-loving plants. Of these there are three, markedly distinct, if we consider the relationships of the plants of which they are composed; very similar if we consider their general appearance. They are

The *American*, reaching its highest development in the Valley of the Amazon. It is excessively rich in species and luxuriant in growth. Secondly comes

The *African*, still imperfectly known but also very rich. Many of its general physical characteristics have been vividly sketched for us in Mr. Stanley's latest work. And third is

The *Indo-Malayan*, including India and all the East Indian Archipelago with the Malay Peninsula, and extending even to Australia and Japan.

The relationships of these three are sufficiently well-known to indicate that while they differ much from each other, they are more alike than are the floras of the South Temperate Zone which we have considered,— a fact tending to show that the former may have been connected with each other more recently than the latter. From this the step is but a short one to the theory some years ago propounded by an English naturalist, that all the floras and, therefore, all the plants of the earth have originated in the northern hemisphere, and that they have spread southward in successive great waves, the more southern and older floras being the most ancient of these, and the more northern floras later in time.

And in conclusion, to sum up the whole matter, I hope I have shown you that while the causes controlling the Distribution of Plants are many and rendered exceedingly complex by their interaction, we can separate out the principal agencies and trace their effects; that the agencies limiting distribution are the needs of plants with reference to the amounts of heat and moisture to which they have respectively become adapted, and also by the past history of each plant placing it in some one region, and not in all to which it is adapted; and finally that the active distributing agent, aside from the comparatively feeble efforts of the plants themselves and man's insignificant effects, has been the successive migrations compelled by past climatic and geological changes, and that these migrations have resulted in the distribution of all plants over the earth's surface into those definite groups or floras which

we have just considered,—which groups probably all came in a series of great waves from the north.

Discussion.

William C. Strong said the lecturer had spoken of the transportation of plants by glacial action and of the gradual distribution of species, and asked him whether he regarded the law of evolution as applicable to plants in such manner as to increase their hardiness, enabling seedlings of species belonging in the flora of a warm climate, ultimately, by a long process, to become inured to a colder climate.

Mr. Ganong replied that the gradual modification of the character and habits of plants was so general and so necessary to fit them to their surroundings in localities where they may be placed either by design or seeming accident, that the known facts could not be explained without supposing it, and it may be taken, to start with, as almost axiomatic.

F. L. Temple inquired whether the plants that were driven south, by the glaciers, far into the tropical zone and had returned, by Nature's slow process, to their original home, were then identical with their ancestors growing there in pre-glacial times.

Mr. Ganong replied that practically they were identical; that, although somewhat modified by the various influences to which they had been exposed during their absence, the intervening time had not been long enough to extinguish the characteristics of the species, some of which indeed are very old and are found fossil in the Tertiary strata.

Mr. Temple asked the reason that plants brought from the southern extremity of South America will not live here in our climate, or in the degree of latitude north, corresponding to their native habitat.

Mr. Ganong suggested that if plants were rightly selected in Fuegia they might live here. But the chances are against it in such cases, unless a gradual acclimatization can be effected. Special conditions, other than those mentioned of moisture and temperature, even if so slight as to be invisible or unknown to us, may become, in the case of wild plants, of vital importance in the face of the intense competition between species each striving to occupy as much ground as possible. The native plants are in possession and the foreigners are not sufficiently adapted to our climate to

cope with them. In case of cultivated plants, difference in conditions of moisture, etc., may be so different here as to prevent their growing even under cultivation. The great evenness of the Fuegian climate and the great extremes of our own, prevent many plants acclimatized to the former, from living in New England. This is proven by the fact that certain plants from the southern part of South America will grow on our Pacific coast, where the climate is much more even than our own.

Mr. Strong spoke of the lecture as one of great interest, and said that its full value will be better appreciated when it comes to us in print. We may not understand the bearings of so profound a subject, or be able to discuss it upon the simple hearing. He then moved a vote of thanks to Mr. Ganong for his instructive lecture, which motion was unanimously adopted.

O. B. Hadwen, Chairman of the Committee on Publication and Discussion, announced for the next Saturday a paper on "School Instruction in Horticulture and its Advantages," by Dr. Charles C. Rounds, Principal of the State Normal School, Plymouth, N.H.

BUSINESS MEETING.

SATURDAY, February 28, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

No business being brought before the meeting, it adjourned to Saturday, March 7.

MEETING FOR DISCUSSION.

THE STUDY OF HORTICULTURE IN THE PUBLIC SCHOOLS.

By DR. CHARLES C. ROUNDS, Principal of the State Normal School, Plymouth, N.H.

Dr. Rounds prefaced his essay by the remark that he was not a horticulturist nor a naturalist, but that what he should say would be spoken out of the depths of his feeling of his own needs in youth, and of the needs of the children of the present day. If his

message should prove not exactly fitted to the needs of the members of this Society, the defect must be attributed to his want of technical knowledge. He then read his lecture, as follows:

The demands so earnestly and widely made for revision of courses of study, from the lowest class in the primary school to the university, is not a freak. These demands are to be met, they must be calmly considered, and reasonable claims must be granted. There can be no fixed course of study best for all persons and in all times. Revisions are compelled by changes in the circumstances of the individual, by new demands which new times make upon the citizen, by discoveries in science and the arts, by new social and civil conditions; and educational systems must be judged, not by their fitness to meet conditions which have passed away, but by their adjustment to the demands of their own time.

If the tremendous inertia of whatever has become institutional be borne in mind, there need be little apprehension of wide-spread disaster from too rapid or too radical changes in courses of study, though such apprehension is not unnatural to those whose field of view is limited. The realized dreams of the wildest visionary could hardly effect so great a change in the schools of the present day as has been effected in passing to the great University of 1891, from the Harvard College of the middle of the seventeenth century, where it was prescribed that "when any scholar is able to read Tully or any like classical Latin author *ex tempore*, and make and speak true Latin in verse and prose, and decline perfectly the paradigms of nouns and verbs in the Greek tongue, then may he be admitted to the college, nor shall any claim admission before such qualification;" when the conversational use of Latin was obligatory upon all within the limits of the college, in place of the mother tongue, which was "to be used under no pretext whatever, unless required in public exercises;" when it was ordered that "every scholar that on proof is found able to read the originals of the Old and New Testaments into the Latin tongue, and to resolve them logically, withal being of godly life and conversation, and at any public act hath the approbation of the overseers and master of the college, is fit to be dignified with his first degree."

The immense changes that have been effected in the higher education since the year 1800, are well known to those now living.

The elder Silliman, elected professor of chemistry at Yale, in 1801, visited Professor Maclean, a young Scotch medical graduate at Princeton, and there for the first time witnessed a chemical experiment. Professor Cleveland, called to teach science at Bowdoin, took a small box of mineralogical specimens to Philadelphia to find a man to name them. Elective studies were adopted at Harvard in 1824, "against the judgment of the faculty." With the advent of Louis Agassiz, in 1848, Professor Pickering's Physical Laboratory at Harvard, in 1867, the general extension of laboratory work in chemistry, and later in biology, we have the laboratory method firmly fixed in science teaching, and slowly making its way downward.

The common school of the early part of the century, I need not describe. Some here probably knew it by personal experience,—more by tradition. Its type still survives in the back districts, though it would hardly be recognized in what we should now style the model school. Yet it may be doubted whether in its best form the transformation has been so complete as in the higher institutions, and whether the common school of the present day furnishes so complete a solution of the problems present to the people of the time as did the school of the earlier day.

All the conditions which have been enumerated as compelling revision of studies have been found prevailing with constantly increasing force for the last half century. Population is rapidly passing from country to city; the urban population of Massachusetts is now seventy per cent of the total. John Ericson, who died so recently in New York, was a working mechanical engineer in England, at the birth of the railway system, and a competitor for the prize offered for the first locomotive engine. Henry and Morse made the telegraph possible and actual in the second quarter of the century, and Edison is still in the prime of his marvellous powers.

The discoveries and inventions which have so increased the power of production and communication, have correspondingly increased the powers of intelligence. In the morning paper we read the most recent history of remote countries; combinations of forces in all departments of human action are speedily made on the most extended scale, and the range of the exertion of directive power is only limited by the powers of the individual mind. There is great significance in the statement of Francis Galton, that the average

intellect of the present day is not equal to the problems presented to it. This cannot be from a diminution of natural mental capacity, but from some failure in training.

It is a legitimate subject of inquiry, even though there be no ground for present apprehension, whether there are any but educational forms to remove the possibility of the world's seeing repeated the supremacy of the few and the subservience of millions marked by the ruins in the valleys of the Euphrates and the Nile.

The educational and social ferment of the present day is a necessary result of the instinctive effort to adapt one's self to the universe in which he is placed, an effort which becomes intelligent and volitional so far as the true relations to that universe are clearly perceived. Mighty civilizations have flourished and have then been overwhelmed and lost in the revolutions and destruction of empires. To trace the causes of their triumph and decadence is a legitimate exercise of the intellect, but this exercise is one of the luxuries of scholarship. Something else is needed to make a people citizens of their own time and participants in the culture of their own generation. However many lost arts there may have been; whatever the character of the sciences the knowledge of which may have disappeared, the sciences and the arts — not the *art* — which mainly give shape and direction to the civilization of the present day, are the growth of the last one hundred years, and most of the education which possesses real power at the present day is *new* education. There are only degrees of *newness*. As a necessary result of the newness of scientific and practical culture, there are gaps to fill out in the system, — there is imperative demand for improvement in method.

In this general discussion it has been my purpose to emphasize the fact that the question which the Horticultural Society this day raises is a part of that larger question of educational advance now moving the thought of the world. And now I would state some grounds for the conviction that the introduction of the study of horticulture into the common school course will supply a force still lacking in our means of culture; that such introduction is easily practicable in country and city schools, and that there is good reason to believe that such an extension of the course of study will serve, in some measure at least, to palliate, when it does not remove, economic, moral, and social ills, the existence of which we deplore.

As a rule new studies are introduced into courses of study on the ground of their practical value, and they maintain their ground therein unquestioned so far as they prove efficient as means of culture. Passing over for the present the discussion of the practical value of the study of horticulture, I will crave your forbearance for a brief discussion, somewhat technical—I fear somewhat dry—of the special culture to be gained from the study, and of its true place in a system of education.

In libraries we have the garnered results of the wisdom of the ages. If Rosenkrantz be right in his statement that it is the end of education to build up in the mind of the pupil a picture of the universe as mature minds have painted it, the library may suffice; if it be the true expression, as I must believe, that the aim should be to build up a picture of the universe as God has made it, we must supplement the study of the word by the study of the thing—the library by the universe itself. It is not the fixed forms of things alone which must be studied, but the powers by which things are produced and maintained, and the processes through which these powers work. If the thing is a pause in the Divine thought, the process is the Divine thought in working.

It is but a low type of mental exercise, yet an essential one, which consists in the mere transference to the memory of words and of notions of things. Real thinking is a more complex process, and knowledge is the result of thinking in a larger sense. The mind grows only by exercise, and care must be taken that it be exercised in the right way and in all essential ways. All processes of thought consist in the separation of wholes into their constituent parts, or the combination of parts into a whole. Since all thinking deals with real things or with previously acquired ideas, we have, as the essential forms of thought, analysis and synthesis, dealing directly with real things or with previously acquired ideas, or, in other words, real and ideal analysis and synthesis. To illustrate from your own special field:—in passing from the real plant as a whole to the observation of its parts, the process is one of real analysis; in following the development of the plant from the seed, the process is one of real synthesis. If the mind, reproducing previously acquired ideas of similar plants, drops specific differences and combines common features to form ideas of genus, order, etc., it is engaged in ideal analysis, as going from the concrete thing to the abstract idea; if the mind,

starting from the general abstract idea, *plant*, adds to it the ideas of class peculiarities in order — the process of the botanist in classification — the process is one of ideal synthesis.

This sketch covers in outline the field of intellectual education, and an educational system must supply the appropriate subject for each of these classes of mental exercise. All are essential to complete culture, and each has its appropriate place and peculiar efficiency. Every mind must start with the real, and most will find here their appropriate field of exercise. Only philosophers and scientists work easily in the the ideal region, and it has been the bane of our education that abstractions have for so long ruled the field, and have been the main exercise of minds but poorly prepared to deal with them.

If it were enough to study one branch of science, if the object were merely to illustrate a process of thought, the work of the teacher would be simple indeed, and the years of study might be few. It does not require argument to prove that the study of all the forces acting through matter is essential to anything like complete culture; hence the divisions of physics according to the forces considered. In addition to the physical forces, vital forces, as acting in plant and animal, must be studied for essential knowledge and also for discipline. The predominance, in our courses of study, of the study of the animal organism, is probably due to the interest excited by the evolution theory. There are apparently insuperable obstacles to the general teaching of this department of biology in the common school. It requires a training and skill beyond the reach of most teachers; the subject in some of its aspects is repulsive to many children, and the study of the processes and laws of the development of animal life is often unfit and impossible for the child. The knowledge of facts alone, however interesting and important in themselves, is not science, which must always sweep full circle. The astronomer studies the laws of planetary motion by comparing the observations of past centuries with his own. The geologist deduces the laws of his science from comparison of stone records reaching through the vast periods of geologic time; the biologist traces the laws of animal development through successive generations. In the study of the plant the circuit of development may be complete in one season; modifications are easily produced and observed, and the subject is at all times and stages beautiful.

To recapitulate:—The four essential processes of thought — real and ideal analysis and synthesis — must all be made subjects of exercise in a system of education. If man is to be at home in the world which he inhabits, he must know not merely things,— he must also be trained to observe the action of the classes of forces by which things are produced. The study of physical forces must be supplemented by the study of these as combined with life forces in the study of plant or animal. The laboratory method must be adopted. The biological laboratory is often impossible; the garden is the botanical laboratory.

Can the means of such teaching be supplied? I must leave it for you, gentlemen, to decide how much good ground is essential to the school garden. There is surely ground enough in the country, and attached to the city school there may be. I found a fine collection of plants on the roof of a school house built for the poor of East London, the boy's playground being also on the roof, and those who have seen the beautiful flower garden on the roof of the market house on Princess street in Edinburgh, will have a vivid idea of the possibilities in this field.

Is such an extension to school work anywhere found? Yes, and as part of a national system, I will read the course in horticulture prescribed by law for the common schools of France, and the course by which teachers are to be prepared in the Normal Schools for the direction of this work. In France, whatever is to be in the education of the people must be in the normal schools. The problem of manual labor was solved there by putting it into the normal schools.

Horticulture takes a place beside agriculture in the courses of study of the normal schools and of the elementary or common schools. The course for the third year of the normal schools for male teachers lays down the following as the subjects treated, under the title, *Fruit and Vegetable Horticulture*.

1. The site (for garden); preparation of the soil; planting.
2. Special culture of trees and shrubs: The vine, the peach tree, the cherry tree, the plum tree, the pear tree, the apple tree, the rose, etc.
3. Grafting.
4. The vegetable garden. The teacher will give special attention to the modes of cultivation and the varieties of plants most important in the section of country in which the school is located.

In the normal schools for female teachers, the instruction in horticulture constitutes a part of the course in domestic economy for the second year, and the subjects are treated in the following order:

The Garden.—General arrangement of the garden: walks, borders, walls, trellises, garden work and use of the various garden tools.

The Fruit Garden.—General principles of the culture of fruit trees, with application to the varieties best suited to the region. Diseases of fruit trees. Destruction of noxious animals.

The Vegetable Garden.—Varieties, cultivation, and harvesting of vegetables. Harvesting, sorting, keeping of grains. Forced cultivation—the hot-bed, the frame, the bell-glass.

The Cultivation of Flowers,—For ornament or for the making of perfumes.

The course for the elementary schools is in general as follows:

Primary Course.—(Pupils 7 to 9 years of age.) Fundamental ideas gained in the school garden.

Middle Course.—(Pupils 9 to 11 years of age.) The instruction bears upon the elements of agriculture: principal kinds of soil, fertilizers, tools, etc.

Superior Course.—(Pupils 11 to 13 years of age.) Horticulture: principal processes of multiplication of the most useful vegetables. Arboriculture; grafting.

The completeness and comprehensiveness of the course in the young ladies' normal schools is especially noteworthy. In the normal schools for young men there is also a course in agriculture, and when it is borne in mind that in each of the eighty-six departments of France there is a normal school for young men and also one for young women; that the education of the common people is a national concern; that the schools are in session for more than ten months in the year; that the courses of study are prescribed by the superior council of public instruction; that school attendance is compulsory from the age of seven to fourteen, and that trained teachers must be employed, the prosperity, the contentment, and the patriotism, of the country people of France can be understood.

The care taken to prepare teachers in France for instruction in this line may be shown by some extracts from a report by M. Boutan, Inspector-General of Public Instruction; speaking for a commis-

sion of inquiry regarding instruction in physical and natural sciences, he says:— . . . . "The garden of the Normal School should always have a nursery of fruit trees, and a square reserved which we will call *the school of Botany*. The pupils will themselves graft the trees in the nursery from their entry into the school, under the direction of a capable gardener; they will thus learn during their three years' course, to train the trees of the garden. They will familiarize themselves with the most usual processes of pruning, and, without a great effort of memory, they will come to know the species of fruit trees which succeed best in the region,—those which, for the general good, should be propagated and made known. Later, when the Normal pupil has become a teacher in a rural community, and shall have a garden, he will take to the school some of the trees which he had formerly grafted, and will transplant them into his little orchard. We wish, in short, to reach this result—that the teacher's garden may be the best kept garden of the town, that it may serve as a type and example. Our country people are opposed to all ideas of reform and of progress when presented as theory and pure science, yet they will become zealous imitators and obedient disciples when example is added to precept—when they are presented with results obtained,—with palpable facts. If the teacher obtains fine fruits and good vegetables in his garden, we are sure that the farmers of the neighborhood will not delay in adopting his processes; that they will take his advice; that they will ask him for grafts, and that soon, and without the need of any other propaganda, good processes of arboriculture will become general. We can cite several departments in which, thanks to the happy initiative of the teachers, the wealth of the country has increased from year to year, and from which the exportation of fine fruit has become the source of considerable profit.

"The little school of botany, during all the pleasant season, will furnish to the teachers and pupils the living plants necessary for lessons and for practical work.

"What we have just said regarding arboriculture applies as well to market gardening. It is no more difficult, in a soil properly prepared, to produce good vegetables than good fruits. It is always during his residence in the Normal school that the future teacher will become acquainted with the traditions of intelligent practice. We note, as excellent to adopt, the custom followed in

some of the establishments which we have visited, of dividing the pupils, for garden work, into several groups. Each group, instead of devoting itself to labor without a result, continues to the end the kind of cultivation which it has commenced. It passes then to a different kind of cultivation, and follows this, too, from the sowing of the seed to the harvest. Following this course each group, during the three years' study, can become acquainted with all the processes relating to the cultivation of the different products of the market garden.

"This important question has been discussed by the commission: Shall the professor of agriculture be asked to consider horticulture, properly so called, as annexed to his course, or must the teaching of horticulture be given to a special teacher? The decision was unanimous for the second plan, for this reason: many teachers of agriculture, very able as agriculturists and as chemists, cannot give good instruction in horticulture; they have never thoroughly studied it; they have never practised it. The pruning and training of trees is known to them only in theory; market gardening is but little less strange. Their only resource, if required to give this instruction, would be to place a book in the hands of the pupil, and to explain the book. The final, inevitable result would be that instruction in horticulture, which we wish to see prosper in the Normal schools, would be sacrificed.

"Hence, we demand that a master-gardener be attached to each Normal school."

The school study of agriculture and horticulture is not peculiar to France among the continental nations, but in several others it receives prominent recognition, however strange this may seem to America.

In this we have another illustration of our educational poverty as regards our contributions to educational theory and practice. Manual training in our schools took its real start from the exhibit of the Moscow Technical School at Philadelphia in 1876, the great value of the theory and method of which was at once recognized by President Runkle, of your Institute of Technology, and others; for the present form of manual training in the common school we look to Sweden, and the adaptation of the Swedish "Sloyd" to the primary school is now brought to us by two sisters —one I believe in Chicago and one in Boston—from Helsingfors in far away Finland.

For physical training in school, Boston has adopted the Swedish system as the best; and the name of kindergarten, and of its author, Froebel, alike show its origin. Until America can show one important contribution of its own, there should be no objection to the adoption of one more educational feature from abroad.

The economic advantages have been briefly stated in the French report from which I have quoted.

The physical advantages in furnishing relief from the stress and strain and a remedy for the dangers of school life and work, as well as of sedentary occupations, are patent. Like advantages may be expected from the furnishing of needed changes in the food and hours and habits of life, of many of our people. One advantage of the study of horticulture in our schools would be that it might change the hours of the active life of each day, even in our cities, by substituting morning hours for those of the late evening. On a larger field the benefit would be felt in its transformation, in some important respects, of the character of country life.

The transference of population from country to city is one of the most marked characteristics of modern civilization. According to the last United States census the urban population of Massachusetts is, as before remarked, now seventy per cent of the total. Many of our States are apprehensive of their future in view of the large and increasing number of abandoned farms. Often sadder than the abandoned farm are the abandoned parents who are going down to death alone on the old place. It is by no means always true that the children who have gone from country to city have bettered their fortunes by the removal; too often they have bankrupted fortune and morals alike. Yet flight was and is inevitable,—it is an instinctive attempt to save the soul alive. To the bright boy and girl on the country farm comes day by day wonderful music from the wondrous world beyond the horizon's bar. In former days the lumbering stage coach brought news—a little—from abroad, as it had slowly travelled the length of the land and been slowly wafted across the seas. Now the express train, the ocean racer, and the magic wire over the mountains and under the seas, make the whole world kin, and inflame the imagination of the youthful watchers in the valley and on the hillside. The magazine comes with its reproductions of art, and its revelations of the beauty which cities have to show. The

summer traveller and the summer boarder come to disturb the dreams of the country maiden, and to emphasize the contrast between the actual and the ideal. With awakened intelligence and quickened taste the mind reaches out for appropriate stimulus as the flower turns toward the sun. And this actual life, so full of toil, so bare of charm — the home with no adornment within or without — you know it, for in your travels you must have seen it. In a day's ride across country so rarely can one see around the country house any hint of garden in the true sense of the term, that when once seen the sight will signalize that day's journey.

The summer homes of those who with more ample means seek gratification of the innate love for the real delights of country life, are marvels of beauty; but these being the creation of wealth and taste are quite beyond the reach of those who live on in the same old way, for lack of the training which is so easily attainable and so strangely withheld.

For another reason are the farms abandoned: their cultivation has become unprofitable. Under proper cultivation we know that fields are fertile after centuries of culture; many of our farms have had their wealth exhausted in three generations. The colleges of agriculture and the mechanic arts, with their four years' courses of scientific study, do not meet this necessity. The people are not given in the common schools even the stones of scientific culture. A large proportion of the farmers in this country have not learned that fertilizers can be taken up by crops only when in solution. They allow the rain to leach away all the virtue of the stock of manure, and put the sticks and straw upon their lands. In the country school not even the simplest laws of plant growth are taught. When in the academy or high school some most elementary knowledge of botany is offered to the few who reach these schools, the study usually covers only a part of the field. In our schools it is generally the case that botany is taught only in the spring; fruits are not studied at all, and the best methods of preserving them are unknown. Some seeds are sprouted in the school-room to illustrate the process of germination. The school grounds are never desecrated by the growing of plants; the kind and preparation of the soil, the selection and action of fertilizers, climatic conditions and their influences, the selection and use of tools, and the actual manipulations of the art,

remain to most of our farmers mysteries still, and generation follows generation in the same dull round.

The facts few will deny; the results we must deplore; relief must be sought and found, if not on this line then on some other, but what?

The economic advantages which would be derived from a wider diffusion of horticultural knowledge and a better horticultural practice need not be detailed before this audience. The physical advantages which pupils in school would derive from spending some time each day in these out-door lessons and exercises, it needs no argument to enforce, and if thus a love for the garden and its better and finer products could become wide-spread, there must result an influence of infinite value upon the habits and lives of our people.

Above and beyond all this, however, there are relations to the higher life of man which should not be left out of the account. In the physical laboratory the scientist deals with forces almost entirely under his control; in the garden the thoughtful pupil sees himself working with forces beyond his control,—forces running toward grand, harmonious, beautiful, beneficent ends, on lines laid down by an intelligence infinitely beyond his own. If the "undevout astronomer is mad," the gardener who cannot discern the spiritual significance, the infinite suggestions, of that with which he deals, must be akin to the clod he turns. There is something in the culture and study of plants that carries the mind outward and upward toward the Infinite. I shall never forget the look, deep beyond his years, of a little boy, much in love with plants, as he broke in upon the conversation in the garden, as the sun was setting, with the question, "Do not plants think? I thought they did." That boy, before taking any lessons in botany had three hundred specimens in his herbarium. The boy has become a man, and a lawyer in New York, but his love for Nature is as strong as ever, and his vacation rambles and studies keep his thoughts fresh and young.

The beauty and the grandeur of natural scenery are beyond the appreciation of many; they often appeal to us with a power which exhausts while it uplifts; we can read their deepest meaning only in our rarest moods. An added meaning and an added grace is given to Nature by the skilful and loving hand.

In the course of study in our common schools no provision has been made hitherto for cultivating a taste for natural beauty.

Although wide districts of our country have been occupied for generations by farmers and their families, many of these dwellers in the midst of our most beautiful, and even grand scenery, have been quite unaware that it possesses such characteristics. A cultivated citizen of Philadelphia discovered North Conway, and his announcement of its charms led to its becoming a fashionable resort for summer boarders. A party of summer tourists wandering over the White Mountain district noticed at one homestead that the barn was so placed as to completely prevent the house from commanding a view of Mount Washington. The farmer, on being asked why his barn was thus located, replied: "When that barn was built *Mount Washington hadn't been discovered.*" The cultivation, in the rising generation, of appreciation of the beautiful in Nature and art would add greatly to their capacity to perform better work in every vocation, especially rural, as well as to their ability to see and enjoy the charms, not only of fine productions of art, and of beautiful and grand scenery, but of all created things. Furthermore, their development in this direction would exert a reflex influence upon the present generation and thus increase the happiness of the whole race.

We read in the beginning of the divine record that God planted a garden eastward in Eden,—and that he placed man therein to keep and to dress it. On the cross the Saviour of mankind said to the penitent, "This day shalt thou be with me in Paradise,"—a pleasure garden. Were there more gardens along the way, the course through this world to a beautiful hereafter would be straighter and smoother.

Dr. Rounds remarked during his lecture that by the extension of courses of instruction in natural science to young women, the fact has been recognized that it is a study entirely appropriate for them.

It is remarkable that, so far as he knows, farming and gardening are the only occupations carried on for fun. Wealthy men go back to their homes or farms in the country and spend money for beauty, but merchants and teachers do not go back to their occupations.

If we take a piece of natural scenery and work it up by the aid of man and it is controlled by man, a new life is given it.

Whatever may be said in the city we know that in times of trouble help is sought from the country. Solitude makes a coun-

try boy thoughtful if he has the capacity for thought. He is brought in contact with a power beyond his reach. The deepest religious sense of the world is connected with communion with nature.

Discussion.

Rev. A. B. Muzzey said that if the presentation of this subject had taken hold of others as it had of him, it was a happy circumstance that they could attend this meeting. When he saw this subject in the list for the season, he thought it the best of them all; it strikes at the root of all the operations of this Society. He would throw no discredit on those who follow the business of horticulture for profit; but he was amazed to see how much some men care for the accumulation of money while they care nothing for beauty. They appear not to comprehend the love of Nature. He stood not long since talking with a man successful in business and possessing a large property, and expressed to him his admiration for a fine orange tree full of fruit, near which they stood. The man replied that he thought the oranges could be raised for seventeen cents apiece. Now that man could not see anything in the plant beyond its market price; but his remark gave the speaker a shock from which he had as yet hardly recovered. He would have every child so educated as to be able to appreciate beauty, especially the beauty of Nature, from that in the commonest things around us, up to the beauty and grandeur displayed in the order and glory of the heavenly bodies. How can a mature person see nothing in the objects around him but their pecuniary value? He was glad to have lived to see a special effort made to interest children in gardening, but even yet there is not enough interest taken in it. The love of beauty should be called forth and developed in the rising generation. The young no less than the middle-aged of the present time should be led to put their hearts into this work, as one of the most effective means of elevating the present, as well as coming, generations. It should be done unitedly, and by all means and methods, up to calling the attention of government to the matter. While children should be trained intellectually, we ought no longer to neglect a culture of the love and appreciation of the beautiful.

Henry L. Clapp asked, What is the object of these discussions? If not intended as a means of education he did not know their

purpose. It has been said, "If you would teach art, Boston is a good place to begin"; but how about horticultural education? We are a Society with a large property and a large income, of which a round sum is annually offered and paid out in prizes. In view of this many people come here and take prizes year after year, and yet, when it is proposed to spend any money to instruct children in horticulture, they say this is not a charitable institution. He believed that Boston *is* the place to begin the work of teaching children horticulture, and not only the theories, but the practical art of it; and that this Society is the most proper organization to initiate that work. In reply to a question by the President, as to whether the Sloyd system should not include horticulture, Mr. Clapp said that the Sloyd system pertains solely to working in wood, with the object of gaining dollars and cents at the end of it, and from its adoption would come only danger of suppressing horticulture.

Leverett M. Chase was pleased with the subject presented and gratified by the essayist's method of treating it. He stated that the movement in this matter, commenced by this Society, had resulted in an application to the City Government to have the arable portion of the school grounds put in charge of the City Forester, and the question would come up before the City Council very soon. He would ask the aid of others here. It is painful to know that so much thought is given to getting money, or devoted to material things, and to see how far the infinite energies of the soul are wasted. While these things are not to be despised, they should not take the first and best thought. There is too little thought bestowed upon spiritual welfare — upon the cultivation of soul life, that it may be elevated and that we may be the better fitted for this life and for the life to come.

Caleb Bates remarked that being past three score years and ten, he was nearing the end, but always felt an interest in the proceedings of these meetings; that he did not know when he came here today what was to be heard, and would have liked to have a few moments to collect his thoughts; but he saw by the remarks of the last speaker that the audience felt the elevating tone of the essay, which had affected him greatly and he would like to say what was unusual in meetings of this character. All are willing to acknowledge that all the natural things in our gardens were made by God, and therefore must be images of principles in the

Divine Mind, and the original must be in the Paradisiacal garden, and what we see here are but imperfect clay models of the original. Thus if we put aside old blinding dogmas we could look through these things right into the spiritual world and see in a degree the things to which they correspond.

By correspondence our growth is represented in the first Psalm as the growth of a tree; a godly man as a thrifty tree growing by a river, and depicted as a well-developed being, able to appreciate the good, the true, and the beautiful; but the ungodly are not so, but are like the chaff, undeveloped. Were the young taught the art of horticulture, the love of nature thereby engendered would be elevating, helpful in cultivating the faculty of appreciation, and would sometime enable them to see and love the good, thus preparing them for the better world.

Rev. Calvin Terry was much interested in the essay; it pointed in the right direction. In former times it was common talk that people did not need much book-learning to become farmers. Now it would sometimes seem that a farmer to be successful, needed all the wisdom and all the learning in the world. But of all the branches taught there are none that give breadth and solidity to character like these horticultural studies. He said the Life of George Washington was one of the first books he read, that he remembered. Everybody has read or heard the story of George and his little hatchet, but he would call attention to another. George once found in the garden, his own name, growing up out of the soil, and ran to his father for an explanation of the wonder. This was given in a religious lesson, illustrating the beauty and wisdom of Divine planning, as well as its necessity, and the omnipotent power of God as displayed in all things. Such experiences in his childhood did more to make the immortal Washington, than all the political influence that was exerted in his favor. Everything that has life in it thinks after its fashion, for God is in it, and he is all thought. "All things in Nature are beautiful types to the soul that reads them."

"Cities grow west," but the speaker was happy to say that he had always grown toward the east. In his garden there is nothing to intercept the rays of the rising sun, and he liked to be there and see their first glimmerings. He wished that all children could be taught to appreciate the first hour of morning with all its fresh beauty, music, and brightness. He thought

such children, when grown to mature years, would not be apt to run away with the funds of savings banks, or other trusts; for they would see God in everything and be impressed always with the thought, "Thou God seest me," and would not dare to sin.

Mr. Clapp said that he had been interested in all the preceding discussion, but was far more interested in the work of educating the people in horticulture; that one stroke of work in that direction was worth more than all the expressions of theory that could be uttered. The saying that this Society is not a charitable institution may be true, but it *is* an educational organization, and he would suggest that if the Society should spend a thousand dollars in establishing school gardens it would do more to promote the objects for which it was founded than could be accomplished in any other way.

Dr. Rounds held up two small books published in Paris, costing to import, one thirty cents, the other forty cents. One, a first-book of agriculture and horticulture, "Le Petit Agronome," was a text-book for the elementary school. It treats of soils and their management, of plants and the modes of cultivation, of domestic animals, their hygienic treatment and their diseases, and of various other matters of great importance to the farmer. The other book was a story of country life, showing the sure reward which comes to the boy who by industry and frugality makes the most of his opportunity on the farm, and the miserable loss which attends the opposite course. One of the characters in the story, M. Barron, after accumulating a fortune in business in Paris, attempts the *rôle* of gentleman farmer, and wastes his capital in experiments which a practical knowledge of farming would have prevented. His wife and daughters scorn the duties of the new position, and persist in continuing in the country the employments and the styles of Paris. The inevitable result, financial ruin, speedily follows. This little book is illustrated with a hundred and sixty engravings, and weaves into the interesting story of life on the farm a systematic treatment of rural economy, and presents a course of illustrated object lessons on the plants, insects, and animals which the farmer needs to know. He knew of no books within the reach of our schools of the character of these, or approximating to them. There is nothing in our common schools adapted to give a love for country life or such knowledge as the farmer needs. On the contrary, our teaching tends almost exclu-

sively towards mercantile pursuits. Nearly all the practical problems in our arithmetics are mercantile,—there is hardly ever one relating to manufacturing, and it may be said never one relating to agriculture. The examples in the text-books on book-keeping are drawn from the store, the bank, and the railroad. It is easy to see that with such text-books the school training and general instruction now given must tend strongly to draw our youth away from the farm, the garden, and Nature, notwithstanding the almost universal natural inclination of childhood to enjoy working in the soil and seeing and cultivating flowers and other crops. Under these circumstances there exists a great need that a strong movement be made to secure the introduction into the schools, of a newly arranged course of study, in which the interests of agriculture and horticulture should have the full share of attention to which their relative importance entitles them.

William H. Bowker alluded to the query, Is it expedient to put more into the curriculum of our schools? and then declared he was heartily in sympathy with Dr. Rounds, and not at all so with the objection that the school course is already crowded. He had with him at his farm last summer, two bright Boston boys, now going through the Latin School; one his own son, the other the son of a city friend. He was one day going over the farm with them, accompanied also by five English boys—sons of his foreman—of whom two were of the same ages as the American boys. As they passed along he would ask questions about various objects they saw,—plants, rocks, water, air, etc. The Boston-taught boys knew nothing about them, but the English lads answered nearly every question. He then asked the names of the capitals of the countries of South America,—also questions about the regions in Africa in which Stanley had travelled so widely. The New England boys were quite ready to give answer to these questions, of which the English boys had not been taught. They had, however, been taught to observe and study Nature,—the things they could see; the Boston boys, on the contrary had not been taught to study *things* around them, but to study *about* things distant from them. Even our country-bred boy or man does not appreciate the great resources of the country for enjoyment; beautiful scenery in combination,—mines of knowledge and exquisite pleasure if studied in detail. He was glad to hear of a proposed course of training in "art appreciation," and believed it would be well to

introduce such a course into agricultural colleges and also into other higher institutions of learning. Indeed, he approved the idea of Mr. Clapp, that this Society should appropriate money to begin such training among the school children. He once offered to pay the Boston boys to make collections of bugs and plants to learn about them, and soon found that a little girl of four years had developed an interest in the pursuit, and followed the example of her elders. He asked why can we not teach the children of this country to know the common things around them before we try to teach them abstract principles.

In reply to Mr. Bowker, Mr. Clapp said there was no need of taking out any studies in the present course of instruction in Boston for the purpose of teaching horticulture, because the School Board had directed that two hours each week should be given to the study of natural history in the three lower grades of the grammar schools. The time had not been spent as directed, but had been given to those studies which seemed more likely to result in dollars and cents.

Mr. Chase said that examination papers contain no reference to these studies. Our system of education pushes the attention of children to the outward and downward, toward the getting of money. Our boys are brought up to worship the "almighty dollar." We must educate the people better, giving more attention to observation of the beautiful and sublime, as well as the useful in the world of Nature. He remembered that when making the passage over Lake Champlain, there were a man and his wife in the party. The gentleman took a good position for observations of the fine scenery and any other attractions which were visible, while the lady established herself in a comfortable seat, and devoted her attention exclusively to a ten-cent Beadle novel. She was fashionably dressed, and had the air of one whose husband was a successful money catcher, but so far as any pleasure or other benefit which the trip afforded her was concerned, she might as well have been at home or in an attic parlor of a sixteen-story hotel in the city, with the book in which her mind was wholly absorbed. We are, as a people, getting developed in body and mind by pursuing low roads. Most of our people seem to prefer to amass money enough to spoil their children, instead of so educating and training them as to fit them to make an independent living for themselves. As a consequence, the

children think, "Father has money enough," and therefore they will do no work. Labor is the primal blessing, and although the speaker believed in teaching arithmetic and the other useful branches in the school course, he would have more time given to out-door culture, as in the French, German, and Swiss schools. Upon the introduction of School Gardens, it might be necessary to call the first boy to take a lesson in it, but the next boy would go right in. Boys should not be taught as if they were all to be college professors. Now, when they go to Harvard, they are not examined to see what they know about plants, but about Greek exceptions.

Dr. Rounds referred to the French system again. The school authorities there, decide what the branches taught in each school shall be, and assign a certain proportion of time for each. A place in the programme must be found for each, and it is found. It is no infliction upon the pupils of a French school to say "Now we will go into the garden." More time is given to school work there than here, but the pressure is not so great and the children are not over-taxed under this system. If horticulture and manual training are introduced into our American schools, they could be added to the course as rewards of merit. He could not believe it would be any worse for our boys to be busy in the school grounds than to be standing around the streets. As matters now stand he could see no way to effect this object except to convert the school committee, and get them to say that a certain portion of time *shall* be given to these studies, and see that it is done, for they are quite as important as true discount or common multiples.

Mr. Clapp said that our educational institutions and business enterprises gave foreigners the impression that if they came to this country, they should be pretty sure to get rich, and, therefore, they came here every year by hundreds of thousands. He added that our national emblem is the American eagle, bearing in his beak a ribbon upon which is written "E Pluribus Unum," which means little or nothing to foreigners; but if the inscription should be changed to "The Land of the Almighty Dollar," it would be full of significance to them. The ruling ambition, prevailing everywhere in this country, that children shall be educated so as to earn their living as soon as possible in the first place, and make as much money as possible afterward, is so strong that most

teachers are influenced to spend the time wisely set apart by the School Board for natural history work, upon other studies, more in line with mercenary motives. So they do not carry out the authorized programme.

Herbert H. Bates, being called upon, said he had been much interested in all the proceedings of this meeting. He thought Dr. Rounds struck the right chord when he said that in gardening we are dealing with forces over which we have no control. To correct a misunderstanding — as he was introduced as teacher of physical sciences in Cambridge — he said there was no provision in the course of study for teaching elementary science in the schools of Cambridge. But there is in Boston, although it seems that it is not observed.

Dr. Rounds remarked that new buildings were being erected for the State Normal School of which he is the Principal, and he hoped to succeed in persuading the Trustees to allow one portion of the property to be used in the interest of horticulture. He had no doubt time would be found for teaching the branches in that department. How beautiful it would be if we could generally have provision made for school grounds of sufficient extent, which in time would form school parks. He then referred to the Reform School at Red Wing, Goodhue County, Minn. The grounds of this institution are ample, and are enclosed by a substantial fence, but the gates are never locked, and there is no appearance of a prison about the premises, yet there is seldom any trouble from efforts to run away. The inmates, both boys and girls, are trained in horticulture, and such is the interest they take in their duties that they find the establishment a very happy home. They boast that in one department of the work, the production of plants, their sales amounted to $1,500 in one season. A fire occurred there some time ago, which caused great excitement among the inmates, and they ran about in wild confusion at first, and people who came to assist in extinguishing the flames, declared that these young prisoners were escaping; but the Superintendent said: "We must put out the fire the first thing." After the flames were subdued, the roll was called and not one of the number was missing. Of course hereditary influences are often manifested, but such is the effect of the system of treatment while there, that, as the records show, less than ten per cent of the graduates fall into the hands of the law after leaving the

school, although without this training not ten per cent would be able to avoid that fate. As much time is given to training them to work as to book instruction, but the elevating influences of the institution are educational and prove very advantageous and beneficial to every one sent there. Dr. Rounds considered it a model of its kind.

O. B. Hadwen moved a vote of thanks to Dr. Rounds for the valuable lecture he had delivered before the Society, which was unanimously passed.

The Chairman of the Committee on Publication and Discussion announced for the next Saturday, a lecture, under the John Lewis Russell Fund, on "Diseases of Trees Likely to Follow Mechanical Injuries," by William G. Farlow, Professor of Cryptogamic Botany, Harvard University, Cambridge.

BUSINESS MEETING.

SATURDAY, March 7, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

No business being brought before the meeting it

Adjourned to Saturday, March 14.

MEETING FOR DISCUSSION.

DISEASES OF TREES LIKELY TO FOLLOW MECHANICAL INJURIES.

By WILLIAM G. FARLOW, M. D., Professor of Cryptogamic Botany in Harvard University, Cambridge.

Ladies and Gentlemen:—On several occasions you have listened to addresses on the subject of diseases of plants and the nature of blight, mildew, rust, and smut, and the habits of the fungi which cause them must now be more or less familiar to you all. I, therefore, shall not attempt, today, to speak in detail of any of the diseases just mentioned, but I am glad that I have been able to accept your invitation to address you at this particular time, because there is another subject of great importance, as

it seems to me, especially for the people of Massachusetts, on which there is wide-spread ignorance and general indifference. If I can succeed, even to a small extent, in diminishing popular ignorance of the matter to be discussed here, it is to be hoped that the present indifference will gradually disappear, for, as has been the case hitherto, the members of this Society can be trusted to do missionary work in arousing the public to a sense of what should be done to remove existing evils.

As far as the diseases of fruit trees and garden plants are concerned, the public have their eyes open and they require little urging to lead them to seek proper means for checking the growth of the fungus-parasites which affect the pocket by injuring the crops, or diminish our æsthetic enjoyment by disfiguring our gardens and greenhouses. But with regard to our shade trees and forest trees there is general indifference and, although what I have to say may appear to be more appropriate for a forestry association than a horticultural society, I have confidence that my hearers will allow me to use the word horticulture in a large sense, and will recognize that this community looks to them as the authorized promoters of all that tends to the welfare, not only of fruits and flowers, but also of our shade trees, which, if well cared for, are both beautiful and useful.

It is a mistaken notion that shade trees do not need care and protection. Nevertheless most persons believe that, unless a tree is to bear marketable fruit, it can be left to take care of itself. Those who live in the remoter country districts might perhaps be pardoned for holding this belief; but those of us who live in thickly settled towns ought to know by this time that the life of shade trees, exposed as they are to the unfavorable or even injurious conditions of the soil and atmosphere of manufacturing districts, is a precarious one. We have all seen the older trees killed off, and know that with each succeeding generation the younger trees are inferior to the older, for those which escape the injurious action of the soil and air are too often injured by the wilful violence of men.

Theoretically, if one is asked what the trees in our streets are good for, he would say, to serve as shade in summer and to beautify the town at all seasons. Practically, however, many people believe that the great use of the trees is to serve as supports for telegraph wires, as ladders for telephone workmen, or

as convenient places for fastening horses. In short, that a tree should be so treated that it may develop a symmetrical form and luxuriant foliage is nobody's business, while, on the other hand, it is assumed that it is the right of every one to fasten his horse to any tree he pleases or to use the branches as supports for wires. The march of improvement, as it is called, never respects the trees. If a sidewalk is to be widened, down go the trees, or their roots are chopped off in such a way as to injure them. If some enterprising man wishes to build a new house on the site of an old one, the old house is sold for a song and is moved off to some distant part of the town, being dragged along through narrow streets crushing and maiming the trees on the way, just as if these public ornaments were of no account compared with private gain. In fact, it sometimes seems as if a good many people believed that one could not do anything to a tree which really would injure it, and that a tree is so constituted that it can grow on in spite of all obstacles.

We should begin by recognizing that a tree is a living thing which is not only readily affected by the soil and atmosphere, but is also sensitive to mechanical injuries to a degree which might not at first be suspected. An animal tells us by its actions when it has been injured. We know the injuries done to trees only by the after effects, which may not be evident for months or even a few years, and it is my special purpose today to call your attention to some of the injurious effects which follow mechanical injuries. The subject is rather complicated and implies some knowledge of the microscopic structure of trunks and branches, but I shall endeavor to avoid technicalities as far as possible.

Before we can understand the harm done by mechanical injuries we must first consider briefly the normal structure of the trunk. If we examine with a microscope a cross-section of a very young twig, we find that the surface is composed of a single layer of thin, colorless cells called the epidermis, beneath which are several layers of larger cells, many of which contain green coloring matter. Then come the vascular bundles arranged in a ring, although they are not really in contact with one another but are separated by what we may call the rays, which pass from the pith to the outer green cells, and are composed of cells not unlike the latter in shape, that is, spherical or polyhedral, or some simple modification of these forms. A longitudinal section

through the vascular bundles shows that the cells of which they are composed are, in great part, very much elongated, so that they may be called fibres, ducts, or vessels. When seen in cross-section, each vascular bundle is wedge-shaped, and, if carefully examined, is found to consist of an outer and an inner part; that is, in respect to the circumference of the tree. The inner portion develops into the hard wood of the stem, while the outer part becomes a portion of what, for want of a better expression, we may call the inner bark, or bast. Between the outer and inner parts of the vascular bundle is a thin layer of small, colorless, brick-shaped cells, the cambium. The cambium is the most important part of the stem, since its cells during the season of growth are constantly forming new wood cells on the inner side, while those on the outer side are forming new cells of the inner bark. The cambium itself does not vary much in thickness at different ages, and, extending continuously throughout the length of the stem, forms the circumference of a cylinder whose diameter increases from year to year. It is important to bear in mind that it is essentially the cambium which is the growing formative part of the stem, whereas the wood cells formed constantly on its inner side soon cease to grow and, although their walls become thick and hard, the cell contents disappear, so that the cells of the hard wood are practically dead and unable to produce new cells. They form a series of hard tubes very important in the economy of the plant, by giving strength and rigidity and serving as means of passage to liquids and gases.

We must consider especially the action of the epidermis and the cambium. As has been said, the colorless epidermal cells differ from the cells beneath them in being thinner and flatter. The latter include the chemically active cells which in the younger parts of plants transform the food elements into special substances of use to the plant.

The epidermal cells, on the other hand, form merely a thin, protective membrane. They serve in the first place to check evaporation and, furthermore, their outer wall is usually transformed into a cuticle which is nearly impervious to water and is unaffected by a good many substances which would injure the walls of ordinary cells. An important property for us to consider in this connection is their ability to resist the growth of the mycelium of many fungi, which, when the epidermis is removed,

are able to make their way to the more delicate and succulent cells beneath, a point to which I shall refer later.

As the cambium constantly increases in circumference and the new wood and inner bark increase correspondingly in bulk, it is plain that the epidermis, unless endowed with the power of increasing in circumference, must soon be ruptured, thus exposing the more delicate cells beneath. The epidermis does not possess this power except to a very limited extent, but to avoid the danger which must follow an exposure of the sub-epidermal cells to the air after the rupture of the epidermis, which must inevitably take place early in the life of a plant, nature makes provision for the transformation of the sub-epidermal cells into a zone of cork cells, which act as a protective sheath after the epidermis proper is ruptured. The way in which cork cells are formed is seen on a small scale when a potato tuber is cut in halves. The wounded cells shrivel and die, but the more or less spherical cells beneath become divided into a series of thinner, flatter cells by the formation of new cell walls parallel to the cut surface, and the walls themselves become tough and resistent. The epidermis of the stems and branches in reality remains intact but a short time, usually only one year, and then is ruptured and soon disappears; but, meanwhile, the sub-epidermal cells, having been changed into a series of cork cells like those mentioned in the cut potato but on a larger scale, form a new protective covering which replaces the epidermis. Furthermore, the new cork layer itself is only to a moderate extent capable of extension, and as the inner parts of the stem continue to increase it is in turn ruptured, and the breaks are closed by the formation of a second layer of cork cells beneath. This process is repeated indefinitely, so that in stems several years old, we have what is in popular language called the bark, composed of several different layers of cork cells more and more split up and cracked externally.

If we now recognize the structure of the normal stem or trunk in its essential points, we can next consider the primary effects of wounds. In the first place, whenever a trunk or branch is wounded, no matter whether by the action of wind or snow, by the bites of animals, by pruning, or by wilful violence of man, nature itself attempts to heal the wound if possible. If the wound is not too great, it heals by natural processes, but many wounds are so large or so severe that even in the course of several

years nature cannot close them. In such wounds disease is likely to arise, which will infect the whole tree, unless man comes to the aid of nature. Let us then consider the question of the manner in which nature acts and to what extent. The two natural protective processes when trunks and branches are wounded are the formation of cork cells and the formation of a callus. The two processes may go on together. If the wound is slight, as when the outer bark is scraped or gnawed off, so as to expose the more delicate cells beneath, a new formation of cork may be sufficient to close the wound. But when, as is very frequently the case, both the outer and inner bark are torn away, exposing the wood, or when a good sized branch is cut off or broken off, the healing process is quite different. You have frequently seen the scars left when branches have been cut away and know that the edges of the wound swell and form a thick, rounded rim which in course of time seems to contract around the wound, and, if the wound is of moderate size, finally covers it. This thickened rim is what is called the callus, and it originates mainly in the cambium which was exposed when the wound was made, and to some extent in the adjacent cells of the inner bark.

To understand what takes place it will be best for us to suppose a simple case of wounding, such as that of a branch six inches in diameter, let us say, which has been carefully sawn across so as not to loosen the attachment of the bark to the wood. The greater part of the exposed surface here would consist of the wood proper with a comparatively narrow circle of the coarse outer bark and the more delicate inner bark. Between the wood and the bark is, of course, the cambium, represented by the circumference of a circle quite insignificant in thickness compared either with the bark or the wood.

Of the exposed parts the wood itself is practically unable to take any active part in the process of healing. It presents a series of open tubes, which are incapable of producing new cells. The cells of the cambium and, to a less extent, those of the inner bark and of the rays which lie near the cambium, are able to produce new cells, and hence, in the case we have chosen as an illustration, there would arise a ring of new growth just around the wood and beneath the bark. This raised ring of new growth is the beginning of the callus.

It is a well-known fact that where the cambium is exposed in wounds, it produces new cells more vigorously than the cambium of uninjured stems. The reason for this, at first sight, anomalous state of things will be easily understood if we call to mind the tension of any normal trunk. A trunk may be regarded as a cylinder composed of a solid axis of wood whose circumference is formed of the actively growing cambium encircled by the inner and outer bark, which taken together we may now, for convenience's sake, call the cortex. The different parts of this compound cylinder grow under different tensions. On the one hand, the inner parts, as they grow, exert a strong outward pressure on the cortex, while, on the other hand, the cortex acts as a sheath which exerts a strong pressure on the parts within. That when the normal pressure is interfered with, the relative growth of the different parts of the stem is changed, is well shown if a slit is made through the cortex to the region of the cambium. The cells of the cambium thus freed from pressure from without grow more rapidly than before in the direction of the slit, so that the wound thus made is rapidly filled by the new cells thus formed, and the new growth may even be so great as to more than fill the gap, and cause a slight protuberance on the wounded side. Furthermore, when the tension of the cambium is relieved by the removal of the cortex, its function of producing new wood cells on its inner side is altered, and microscopic examination of the new wood formed in wounds shows that the wood cells are shorter, and the vessels decidedly less numerous than in normal wood.

The description which I have given of the way in which the callus arises, although you may perhaps think it somewhat complicated for a popular lecture like the present, is, in reality, a brief attempt to sketch the process in its main points only, omitting many details which are of interest to specialists. What I have described is the normal mode in which the healing process begins, and is to be seen in those seasons of the year when the cambium cells are active. During the colder months of the year, however, the cambium is in a dormant condition, and if wounds occur at such seasons, the cambium is not able to form a callus at once, and the process just described does not begin until the season of plant growth returns. Meanwhile the exposed parts will probably have been more or less affected by weathering, and the closing of the wound by natural processes is made more difficult. In the

case of large wounds the callus continues to increase and overlap more and more the old exposed wood, but its activity diminishes from year to year. As soon as the callus ring has begun to form, its outer cells undergo the cork-transformation, and thus the delicate cambium cells are soon covered with a protective bark similar to the normal bark of the stem, and, as this bark increases in thickness, it exerts an increasing pressure on the cambium cells beneath, which sufficiently explains why the, at first, luxuriant production of new cambium cells gradually diminishes. The function of the cambium in the normal trunk, you will recollect, is to produce new wood cells on its inner surface and new bast cells on its outer surface, and the same function is retained when it grows into a callus. We find, therefore, that in the callus itself new layers of wood are formed and overlap the old wood, and, if the process goes on long enough, it happens that the old wood is entirely covered by new layers of wood and a cortex somewhat similar to that of the uninjured trunk.

So far, we have supposed that we were dealing with a wound made by cutting directly across a branch. What is true in this case is essentially true of other wounds, and we cannot now stop to consider in detail the innumerable modifications depending on the form of the wound. As a matter of fact it more frequently happens, as when branches are broken by the wind or snow or by external violence of any kind, that the wound is irregular or splintered, and in such cases the cortex is often torn away from the branch below the wound and the cambium is crushed or injured. Consequently the healing process is very much hindered. Again, when trees grow thickly together, or for other reasons, the lower branches often die and break off at a certain distance from the main trunk. In such cases the stumps of the branches very often die and remain projecting as dead plugs or pegs. This is in part owing to the disturbed nutrition of the stumps, a subject too complicated to be described here. The fact is evident, however, that such pegs do not heal over but rot away, and must be considered open wounds.

Up to this point I have dwelt upon the nature of wounds and the healing process adopted by nature, and you will now ask, Why are all these elaborate changes necessary? What is the harm if a wound does not heal over? As a rule it is safe to say that the provisions of nature are always adapted to some special end, and

we should naturally infer that, since nature always does her best to heal wounds, it must be because the plant would otherwise suffer. Experience certainly shows that open wounds are dangerous in plants as they are in animals, although I would not go so far as to say that they are inevitably dangerous. There is no doubt, however, that in most cases they are dangerous. Every surgeon recognizes the dangers attending open wounds in animals, and, before the days of the antiseptic treatment, the dangerous and often fatal results of operations were due in many cases to the entrance of germs from the air into the system through open wounds. In the same way wounds of plants are dangerous, although a fatal result may not be reached before the expiration of several years. Naturally the intact epidermis of the younger parts of plants and the corky bark of the older branches and trunks prevent the access of the spores and mycelium of fungus parasites to the more sensitive tissues beneath. Where the bark has been removed, they may and often do work their way into the interior, and cause, at first, a local and, later on, a general decay of the trunk. The fungi which are the agents of destruction in such cases are not the rots, smuts, or mildews, which affect rather herbaceous plants than trees, but fungi of the toadstool family. Those of you who have watched the larger wounds of trees must have often seen clusters of toadstools of different kinds growing out of the wounds. They are most frequently seen in the warmer months, but there are a few species which are to be found even in the mild weeks which sometimes come in midwinter. Besides the fleshy toadstools there are many species of punk-fungi, belonging technically to the same family as the toadstools, which infest wounds, and they are so tough and hard that they can be found throughout the year.

The question might arise whether these toadstools and punk-fungi grow in wounds because the exposed wood is already dead and therefore furnishes food for the fungi, or whether, on the other hand, the death and decay of the wood are brought about by the presence of the fungi. In a certain sense both these questions may be answered in the affirmative. When the exposed wood dies, it furnishes a soil in which the spores of the toadstools and punk-fungi can germinate and grow, and it is also true that when they have once begun to grow, many species are able to make their way downward and upward into the healthy parts of the

branches and cause them to rot. It is a very common experience that the rotting which began in a wound gradually extends to the main trunk, so that although the bark, except where the wound exists, appears to be perfectly sound, on cutting the tree down, the whole trunk is found to be rotten or hollow.

What happens, except in very small wounds which heal at once, is as follows: The porous wood takes up moisture from the air in greater or less amount according to the season, but in almost all cases enough to cause the outer exposed part to decay in the course of from a few weeks to a few months. Not only is water absorbed from rains and mists but dust and other organic substances gradually collect on the surface and there is thus formed a sort of soil, in a thin layer to be sure, but enough to support, at first, the growth of bacteria, which help on the decay of the solid parts, and, later, offer a favorable field for the germination of the spores of toadstools. A very small amount of damp soil is sufficient to start the growth of these toadstool-fungi. Their spores, when they germinate, give out a series of branching threads, the mycelium. The threads gain strength as they grow, and, in a good many species, they at length acquire the power of dissolving the walls of the sound plant cells, even if they do not in the beginning possess this power. Aided by the increased moisture, which is favored by the presence of a damp, earthy layer on the surface of the wound, the destructive threads make their way slowly along the interior of the trunk, the process of destruction causing an increase of moisture and sliminess, which only makes the ultimate destruction of the hitherto sound wood the more certain. While all this is going on within the trunk there may be no definite indication on the outside of the harm done. The toadstools, as we call them, are the fructification of the fungi, of which the threads are the organs of vegetation, and it is not until after the latter have attained a somewhat advanced development that the toadstools themselves appear on the surface. Their appearance almost invariably indicates not that trouble may be expected, but that the disease has already made considerable progress.

The toadstools and punk-fungi, of which I have spoken, are usually not limited in their growth to any one species of tree, but may grow on a good many different kinds. There are some species, however, which attack only particular kinds of trees, and among the number are forms which are more virulent and rapid in their

action, especially those that attack the roots when they are wounded. It is not my purpose, nor would the limited time allow me, to give an account of these special parasites. Enough, however, has been said to demonstrate the danger of open wounds and the necessity of aiding Nature in her efforts to heal them. In the natural course of events many wounds must occur from the violent action of the wind and snow, and we should do what we can to remedy them. But it is perhaps more to the purpose that, recognizing the danger, we should use our influence to prevent the avoidable and wilful maiming of our shade trees by careless and ignorant people.

As far as the treatment of wounds is concerned, our object should be to cover the exposed surfaces, so that moisture, which would cause them to rot, may be excluded, and that the spores of fungus parasites may not find an entrance. A useful hint as to to what should be done is given us by nature herself. In some respects the coniferous trees suffer less from wounds than other trees. The reason is that in the wood of conifers there are canals or passages which contain resinous substances, and when the wood of such trees is wounded they exude and form a close varnish of resin over the exposed surfaces, which are thus kept dry and protected from weathering. As a result, the wood is less likely to rot than in the case of other trees whose wood contains no resin. In trees of the latter description, when wounds occur by accident or design, the indication, to use a medical expression, is to coat the cut surface with tar or some similar substance. There are several practical considerations to be borne in mind in applying the tar. If the wounded surface is rough and splintered, it should in the first place be made as smooth as possible, and where branches have been broken off a few inches from the axis from which they sprung, they should be sawn off close down to the main axis.

When branches are to be pruned, it is of importance that it should be done at the right season. It might be inferred from what was said previously that the summer months would be the best time, because the cambium is then active and the callus begins to form at once. There are, however, other points to be considered. Unless the branch is small, it will take several years for the callus to cover the whole wound, and, meanwhile, the exposed wood may rot unless well coated with tar. The important

question then is not so much to select the season when the cambium is most active as that when the coating can be most securely applied. During the warmer months the cut surface is kept moist because the cells are then more succulent than in late autumn and early winter, and it is not always easy to apply the tar closely under such circumstances. The pruning of deciduous trees should, when possible, be performed in the late autumn or even in early winter, rather than in summer, since the tar then adheres better. Another important point is to saw off the branches carefully, so that the cortex may not be torn away from the wood, leaving the latter projecting. This is always a more or less difficult matter, because unless the cut is made in a horizontal direction, which is seldom the case, the weight of the branch itself, during the process of sawing, tends to tear away the cortex on the lower side of the cut. Where it is possible, the branch should be propped up during the cutting, and special care should be taken that there is no tearing of the cortex on the lower side. Even under favorable conditions, a pocket is apt to be formed on the lower side of the wound, and the application of tar at this point should be made with great care, since wounds are almost always vertical or oblique rather than horizontal, and rain and moisture naturally collect at the lowest point of the wound, just where the pocket is unfortunately made in cutting. It is evident that too great care cannot be taken in covering this part thoroughly.

After this sketch of the nature of wounds and of the danger with which the life of trees is threatened, I trust that what I have said in regard to treatment will appear rational and practical. I must not, however, close my remarks on this subject without uttering an emphatic protest against the way in which the shade trees of our cities and towns are treated. The responsibility rests not only with those who, perhaps unintentionally and ignorantly, are directly guilty of what an enlightened public opinion should regard as vandalism; but it rests in part on ourselves, if we do not in all possible ways seek to give to the public, information, and attempt by all legal means to secure the enforcement of such regulations as shall assure proper protection for our trees. As it is, the care of the trees in our public grounds, parks, and streets is too often placed in the hands of those who are ignorant of the principles of vegetable physiology, and their efforts to prune and cut down trees are guided only by what seems to them temporary

convenience, or by what commends itself to their not infrequently perverted sense of the beautiful. When the whim seizes them and they wish to get rid of a stately tree, it is only necessary for them to say that it is rotten, and dangerous because likely to fall. Many times I have seen trees whose shade could ill be spared, cut down because their trunks were rotten, when examination after they were felled, showed that they were sound and would have lasted many years. It ought to be considered a crime to cut down a handsome tree—certainly in public grounds—unless compelled by absolute necessity. When it is thought necessary for the public safety to destroy animals supposed to be suffering from contagious diseases, there is, at least, a consultation, and the opinion of experts is asked. I hope that the time will come when it will not be allowed to cut down trees which are public property, except on the advice of those whose training entitles them to be called experts.

If one is amazed sometimes at the abuses of trees on the part of those who are their authorized guardians, it must be admitted that the poor condition of our trees is principally due to the recklessness of the public. The streets of Boston and the suburban towns are notoriously narrow, as are also the sidewalks, and in consequence the trees are more subject to injury than in regions where the streets are wider. In most of our streets the trees are very near the edge of the sidewalk, if they do not project into the street itself. Those on the corners of the streets are almost sure to be grazed by passing vehicles, and as wagon after wagon passes along, the grinding process is kept up until the wood is exposed. It is perhaps fortunate that such trees are short-lived, for they become very unsightly, and when they die, the curbstone can be replaced as often as is necessary.

Walk along any of our streets where the trees are placed on the edge of the sidewalk and notice the effects due to our general negligence. In some instances you will find that the house-owners have placed guards around the trunks, and the trees are symmetrical and have attained a good size. But in most cases, they have been left to take care of themselves. Bright and early the milkman comes along and jumps off with his can, leaving his horse to make a scanty breakfast by gnawing the bark of the nearest tree. Later on come the butcher and the grocer, whose horses lunch upon what was left by their predecessor, inflicting an amount of

damage to the tree limited only by the length of time which their owners are pleased to spend in conversation with the girls in the kitchen. Last of all comes, perhaps, the doctor, whose visits, if they are not frequent, are proportionally long. He, at least, ought to know that trees cannot be wounded with impunity. No wonder that the bark is not only soon removed and the wood exposed, but since the horse is an animal which prefers the softer bark to the harder wood, the fresh borders of the wound are repeatedly attacked until deformities of enormous size are produced, and apart from the danger of fungus growths, the nutrition of the tree is seriously deranged. A visit to Oxford Street, Cambridge, where on one side of the street the trees have not been protected, and wounds more than two feet long have been made by horses, will show that I am not exaggerating. If I mention this particular street, it is because I have to pass through it every day. Other equally bad instances might be named.

Surely there can be no excuse for such senseless and wholesale violence, especially since the remedy is so simple and so inexpensive. The trees planted along the streets are not the private property of the house-owners, with which they can do what they please. The public has the right to demand that the trees be properly guarded and protected, since otherwise it is not possible to secure the requisite shade in summer. But apart from the public rights in the matter, it is for private advantage as well that our trees should be kept in good condition, since the attractiveness of any street as a place of residence depends largely upon the beauty of the trees. Not a few of our New England towns owe their prosperity as summer resorts to the arching elms and well-rounded maples, whose loss no money could replace. It would be both just and wise for every thickly settled town and village to have laws compelling house-owners to place proper and sufficient guards round the trunks of trees growing by the roadsides, or if it be considered inexpedient to place this apparently slight burden on private individuals, it is at least the duty of municipal and town governments to provide guards and railings at the public expense. It is strange that there should be any person who lives in his own house, who would not willingly do all he can to beautify it by keeping the trees near it in the best condition. But, unfortunately, there are many such persons. Where houses are rented, the tenant is naturally little inclined to any expenditure

however small, for the benefit of the landlord, and the latter is less inclined to spend money where he does not see that he is getting a direct benefit for himself. To let the trees become shabby or go to utter destruction is a short-sighted policy for any individual or community.

In short, an effort should be made to secure legislation which shall make compulsory the placing of guards around trees in exposed places. Furthermore, the care of the trees in public grounds should be entrusted only to persons specially trained for the purpose. An engineer may be admirably qualified to construct good roads, but it does not, therefore, follow that he knows how to manage trees, and even those who have attained great skill in the cultivation of flowers and the arrangement of flower-beds are not necessarily the best persons to look after trees. The desirable legislation can probably be secured just as soon as the public understand why it is desirable and necessary. It is all very well to talk about the protection of forests and the formation of national parks in distant states. But we have our own forests, which are the trees in our streets and public grounds, and before turning our eyes in other directions we had better see what is needed at home. It devolves upon you, ladies and gentlemen, so to educate the public in this matter that they shall soon learn to recognize that a tree is something to be respected and protected. It is not enough that we erect commemorative tablets before a few historical trees, and take strangers to see, not so much the trees as the tablets. Historical association may lend an additional interest, but every well-developed tree has that within itself which should command our respect and admiration,—its beauty and its utility.

The lecture was illustrated by views, thrown upon a screen, of wounds caused by the gnawing of horses; specimens of skilful, and of careless pruning; stumps of broken branches, etc., showing the progress at different stages of Nature's efforts to heal them. Several kinds of fungi which are found upon and in such wounds were also shown, with the method of their growth and appearance at different stages of development. This exhibition included front, side, and sectional views, which, with Professor Farlow's explanations, afforded a very clear and complete idea of the subject.

Discussion.

Rev. Calvin Terry said that he appreciated the subject of this lecture. From what the speaker had told us the logical conclusion would appear to be that special legislation is necessary. There should be a special Board of Commissioners in each town as well as city, who should have entire control — with due regard to the rights and wishes of the abutters — of all ornamental trees and shrubbery in the streets and public grounds. Such officers should be experts, or persons who are well fitted by education and experience acceptably to discharge the duties of that office. At present these matters are mostly left to the discretion and mercy of the knights of the pick and shovel, who know little or nothing of the needs of such plants and are more apt to damage than to protect them. He spoke from sad experience,—he could not forget his feelings when he reached home on one occasion and found some of his trees seriously damaged and permanently disfigured.

O. B. Hadwen said that he had been delighted with the lecture, as he appreciated highly the importance of protecting and taking good care of trees. He had been one of the Park Commissioners of Worcester since 1867, and with his colleagues had had many encounters with the Commissioners of Streets, whose workmen seem determined to injure trees which impede their progress in setting curbstones. However, they have improved somewhat, as there is less damage done now than in former times. Referring to injuries from other causes, he spoke of a fine tree that was considerably burned on one side during a conflagration in 1842. The tree was about two feet in diameter and in vigorous growth at that time, and directly began the work of repair. This has been continued ever since and the wound is nearly closed over although there is a cavity behind the new growth. It bids fair to live many years, and he thought it a rare instance of such restoration. The speaker recommended that when private citizens set trees in front of their premises, they put them within their own lines, in order to retain control of them, and avoid a great deal of annoyance from many sources. Trees add largely to the beauty of our villages as well as cities, and the people take pride in such adornments, but they need protection and should have it.

Leverett M. Chase had been much pleased with the lecture. He felt a deep interest in the subject and believed there was need of some action to educate the people up to a love for trees that will ensure their protection. In foreign countries he had seen with delight the trees which adorn the streets; not only ornamental varieties, but rows of fruit trees, the fruit of which the owners can gather, their rights being protected and respected, even by mischievous boys who take delight in stealing fruit. Often certain trees are marked to show that the public are welcome to their fruit. The protection of owners' rights is an encouragement to the extension of such planting upon the streets. As a contrast to this system, he cited a case in this city, where a man bought an old barn, for fifteen dollars, and moved it three-fourths of a mile, over streets lined with old shade trees. Of these, thirty-one were mutilated more or less; in one case, a branch about eight inches in diameter was cut off, disfiguring that tree greatly and permanently. The aggregate damage on that route amounted to very many times the value of the building, and all might have been prevented had the authorities in that case received a right education, and possessed a true appreciation of all the circumstances.

The selection of trees for street planting is also very important. Mr. Chase said his favorite was the maple; and among others, he liked the American elm and birches. He would have all pruning of trees done by trained men. Ignorance of proper times and methods of doing this work causes the destruction of many fine trees and shrubs. By pruning fruit trees without due regard to the time of year and also to the balance between roots and foliage —the latter serving as both lungs and stomachs—not only the quality and quantity of fruit has often been diminished, but many valuable trees have been destroyed. We, as a people, are far behind the ancients in love and reverence for trees. Xerxes placed golden ornaments upon a fine plane tree, and detailed a guard to protect it while his army was passing by, in order to secure its preservation as an ornament, and its grateful shade for that place in coming time. Even in the old mythology we often read that trees and groves were held sacred, and the gods are represented as punishing those who wantonly destroyed, and rewarding those who strove to save or protect, these valued productions of Nature. The cases of Erisichthon and Rhœcus were cited as illustrations which perhaps were not wholly embodiments of mere

fancy. The speaker believed that we have need of ornamental trees to promote the best moral and æsthetic development of the people.

Mr. Hadwen, in answer to an inquiry, stated that the Worcester Park Commission consists of five members, each holding his office five years. One member is elected each year, and all serve without pay. Some members have been re-elected continuously for a long time, while others have served but one or two terms. As a rule they take a strong interest in their duties, which include the planting and care of trees in streets, and the control and direction in the management of the parks of the city, which are now ten in number. They must be consulted if a building is to be moved on any street; and if any action of the street commissioners interferes with their department, the former must respect the suggestions of the park commissioners. He said that Ex-Governor Lincoln had a high regard for the trees in the streets, and on one occasion, when he saw a stranger about to tie his horse to a tree, he remonstrated. The stranger said his business was urgent and that he had no time to find different accommodations, whereupon Mr. Lincoln proposed to hold the horse while its owner was engaged, and he did so, thus preventing the injury to the tree, which had been threatened.

William C. Strong thought it was apparent that we ought all to labor to get Park Commissions in our own towns. He then asked the lecturer about washes for exposed places where branches had been cut off, or accidental wounds made upon the stem of a tree. He had used a compound of wax and alcohol, and inquired if alcohol was injurious to the trees.

Professor Farlow said that a mixture of grafting wax and alcohol, so proportioned that upon its application the wax would harden at once, he should consider good, and that the alcohol in such a compound could not of itself be injurious. He recommended pine tar, although some other preparations might serve the purpose as well.

Robert Manning considered tar poisonous to trees. His father used a mixture of tar and red ochre, but his observation was that it injured the trees — mostly pear — to which it was applied. For his own use he preferred a paint of linseed oil, which he believed harmless and quite as serviceable as any other yet named. Yellow ochre had proved very effectual in preserving the wood, but he liked to have the paint as near the color of the bark as possible, and used lead as a basis.

Mr. Strong did not approve of paint or shellac, and believed tar to be injurious. He had used grafting wax dissolved in alcohol, with good effect, but would like to find a better compound for the purpose.

Jacob W. Manning said that in training young trees for planting in streets he would advise pruning the lower branches away to ten or twelve feet from the ground, rather than allow, as we sometimes see in older trees, large branches to start out from five to seven feet from the ground, which eventually have to be cut away, not only destroying all beauty of form, but leaving a wound that may never be healed. He thought the American elm one of the very best trees we have for street planting.

Mr. Hadwen was called upon to answer the question: What is the best time to prune apple trees? In reply he said playfully "When your saw is sharp." For young trees any time that they appear to need it is suitable; but for fruit-bearing trees he should prefer to do it in April or May, when the branches are more readily bent without breaking. The older the trees, the more surely they should not be pruned in autumn. When pruning in May great care must be taken not to start the bark from the wood, and, as one safeguard in this respect, it is always better to cut the under side of a branch before cutting the upper side. To the question: "Will not spring pruning damage buds?" he replied that if the workmen are careful no harm need be done.

Mr. Chase said he thought the lecture was one of the most interesting and valuable we have heard this season and moved a vote of thanks to Professor Farlow, which was passed unanimously.

Mr. Hadwen announced that on the next Saturday, Charles L. Allen, of Floral Park, N. Y., would read a paper upon the "Scientific Education of Gardeners."

BUSINESS MEETING.

SATURDAY, March 14, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

No business being brought before the meeting it

Adjourned to Saturday, March 21.

MEETING FOR DISCUSSION.

The Scientific Education of Gardeners.

By Charles Linnæus Allen, Floral Park, N. Y.

Education is the development of the human faculties and the training of them in such a manner that all the forces of the intellect act in harmony in whatever direction reason or taste dictates. Education, when united with industry and perseverance, enables a man to reach the highest social, political, professional, or business position.

All that there is or can be gained in life is proportionate to the development and application of our natural gifts. As a rule, intelligence, the fruit of education, combined with industry, invariably wins; while ignorance as surely fails in solving the great problem of life,—how to secure success. This principle is universal in its application. It applies to all men and to all conditions of life. It does not affect the principle that some men of rare intelligence do not succeed in business, or that some quite illiterate or ignorant men are prosperous. There are many causes of failure other than educational, but there is one fact which cannot be disputed, namely, that no business ever prospered unless talent, trained or untrained, stood at the helm. The occasional success of a man in business who rarely reads and never writes anything more than sometimes to sign his name, shows us a man of natural talent who would have been a power for good in the land had his mind been properly educated or disciplined. The well educated man is, relatively, a great many men, for, besides his own natural resources, he has the experiences and observations of other men to guide him. It is only the liberal-minded man who will profit by the experience of others; he learns both by their successes and failures.

The greater our natural abilities, the more important it is that they should be properly trained. Talent should be wisely directed. Untrained talent is a dangerous element; it is like a spirited but unbroken horse, quite as liable to go wrong as right. Confucius said, "Learning without thought is labor lost. Thought without learning is perilous." This truism frequently confronts us in our business relations. That all men should be educated in order to develop their full capabilities, does not admit of a doubt, the only difference in opinion being as to the degree.

The subject for discussion today is "The Scientific Education of Gardeners." The term "scientific" seems to stagger many men, particularly our practical gardeners, who, as a class, are men of great natural shrewdness and superior ability, close observers, and men of keen perception, with an innate love of the beautiful in form and color — men whose noble instincts make them liberal to a fault. Such men are quite apt to think there is a conflict between science and practice. This is a great mistake. They are simply cause and effect. The general impression appears to be that science is a degree in the scale of knowledge that is only conferred by some institution of learning; that scientific men dwell in a peculiar atmosphere and possess some hidden facts not easily attained. Let us refer to Webster for a true definition of the word:

"1. Knowledge; penetrating and comprehensive information; skill; experience, and the like.

"2. The comprehension and understanding of truth, or facts; investigation of truth for its own sake; pursuit of pure knowledge.

"3. Truth ascertained; that which is known."

A simple definition of the word "science" would be, exact fact, which is alike applicable to industry, general intelligence, order, manhood, and correct business habits. The only difference between a scientific and any other fact is, that the one is exact, methodical, punctual, and critical; the other not. This difference is seen also between two gardeners having the same general outfit as to appliances, and tools or implements; the one has everything orderly and in its place; the other, everything in a heap.

With these simple definitions of science, let us make a few applications in the order named, first stating that when a young man chooses an occupation for life, he should have three distinct objects in view: First, to establish himself in business that will with industry and economy provide him with a home and a competence in old age; second, to be a leader in whatever profession or business he may choose, honored and respected by all men; and lastly, to pursue some line of thought or study allied to his business, the influence of which will make old age beautiful through the pleasant memories of a life well spent.

Success is, or should be, the warp and woof of every young man's ambition. He naturally wants to tread the path that is the

shortest and most direct to wealth, honor, and distinction. There is not a young man of fair intelligence and with an ambition that knows no failure, who will not be ten times more likely to succeed in the horticultural field than in any other walk in life. He will, moreover, satisfy all the desires of his ambition. It is to be supposed that he has no capital at the start other than strength and determination, and these are all that will be required if he is scientific in his methods. If wise he will consider well every step; he will estimate the chances of success and the possibilities of failure. Because the life of the gardener is one of toil, he should not be discouraged and get enamored with city life. The excitement that evolves from the whirl of active business, and the honors that are shown those who attain high distinction in their profession, are truly fascinating, but we would caution every young man against indulging in hopes that so rarely ripen to fruition.

If a gardener wishes to reach distinction, he must become scientific in everything that relates to his business. His industry must be proverbial; he must never be in haste, but never idle. To accomplish the most in a given space of time with the least possible expenditure of labor is the science of industry. His intelligence should know no limit. There is no other field so broad or so beautifully diversified as the garden. A thorough knowledge of plants and their requirements is the key to success. The old truism that "knowledge is power" is more plainly exemplified in the life of the gardener than in any other calling. No man who commences to build up a business career without capital, will be so greatly benefited by a complete knowledge of his work as he. A gardener who has a thorough knowledge of every plant he handles, has an education that his employer covets; it brings them together in harmony; they converse freely over a favorite plant upon terms of human equality. The more the gardener knows, if he is willing to impart it, the more important he is to the position he fills, and the greater will be his chances for advancement. Many gardeners get a very wrong impression when they enter upon a new situation. They feel as though interests instead of being mutual are antagonistic, that the conditions are as master and servant, while such a feeling never enters the employer's mind,—that is if he is a man and has a garden to gratify a love for the beautiful—and I pity the gardener who has charge of a place where flowers are only grown

as external evidences of wealth. Flowers should never bloom, or fruit ripen, for such men, for they have not the slightest appreciation of the gardener's work and worth, or the respect they owe their fellow man. The gardener's home is with the man who has a bond of sympathy in his heart, rather than sympathy only with his own wealth. Many gardeners get to feel that the owner of a place has no right to do as he likes with his own,—that if he wants a flower or fruit for a friend it must be taken only with the gardener's consent. We know this feeling is common, but we do not think it is by any means general.

Every true lover of flowers, and the gardener more than all others, knows that they who see a flower only with their eyes see but little of its real beauty. It must be seen through the understanding to be appreciated. It is the life in the plant that is truly beautiful. Each and every plant is a teacher, and they who understand "plant talk," can impart to others information far more fascinating than the work of the poet's imagination. Let the gardener make it a rule to show his employer, every time he enters the conservatory, some of the hidden beauties of the plants,—some fact in relation to the phenomena of plant life; how it feels and understands; let him point out those wondrous facts with which his mind is stored, as though he were a brother or a friend, and there will soon be established a mutual and endearing friendship. This is the scientific way of managing an employer and it is a sure stepping-stone to success. There are but few gardeners filling responsible positions in our country, who, if they will unite with this disposition habits of industry, integrity, and good nature, will not find in their employers never failing friends,—friends who will gladly assist them, if need be, in establishing a business of their own.

The opposite of this is too often the case. We have known instances where conservatories have been sold and places given up because the owner and the gardener could not work together in harmony. Now we do not for a moment think the gardener intends a wrong,—far from it: it is simply a mistaken idea of his rights and duties and if it were not for this, there would be many more employers than there are now.

There is a science in manhood and honor with which the gardener should become familiar. As facts are scientific, we wish to state a few very plain ones that every one can apply to himself or

reject, according to the facts in the case. It is the almost universal practice in some countries, and sadly too common in this, for gardeners,—and they are not a particle different from other employés, to expect, yes, to demand, a commission on all purchases made for their employers. This method of getting extra compensation from an employer, without his knowledge, is a sad injury to one of the most beautiful and honorable professions that man ever followed—that of the gardener—not only in the breaking down of manhood and common honesty, which entails the loss of character, but in creating a lack of confidence on the part of the employer which will not permit him to make the advancement in wages and position that he would otherwise be glad to make. Some of the English seedsmen have repeatedly told me that most of the head gardeners in that country bought, annually, fifty times more seeds, in value, than they could possibly use, simply to get the commission. Our observation shows that this practice is on the increase in this country. We have been asked for the commission frequently, the parties claiming it as a right, saying "all seedsmen allow it." But all do not. No man worthy the name of seedsman will compound a fraud of this kind and no man worthy of the name of gardener would do otherwise than reject an offer which would disgrace himself and cast a blight on the whole fraternity. We know many gardeners who feel keenly the disgrace heaped upon them by their dishonorable associates. A gentleman who owns a large place recently told me that he should be glad to give me his order but he dared not, for if he did his garden would be ruined for the season. He knew why seeds were bought elsewhere and said it was cheapest to keep quiet and submit to the imposition, and further, that but for this he would largely extend his area of glass,—in fact would be glad to start a commercial place and give his gardener the lion's share of the profit, but he could not trust a man who would practice such little irregularities. Now, I do not think a large proportion of our gardeners are dishonest in this respect, but the few work great injury to the whole. It should not be so, but it is, and the young gardener looking for success in his profession should reject with righteous indignation all emoluments of this character, which, I am sorry to say, will be freely tendered him.

But to return to the question of practical education. Where can it be obtained? Taking it for granted that a young man has

at the start a fair rudimentary education, the garden is the school to attend, where every plant, animal, and insect is a teacher. These must all be learned; they are the elements of that education which will lead to distinction. As science is the exact knowledge of things, here are the objects to be learned and loved. These terms should be reversed in the order given, because if the object is not loved it can never be thoroughly learned. And we would say here that if a young man does not love the garden and all therein, he should enter some other profession, for there is no more pitiable object in life than a man following a profession that he does not enjoy.

Systematic botany need not necessarily enter largely into the gardener's education, but though he can do without it he will be far more proficient with it. A genuine love for plants will create in him a desire for a knowledge of their systematic order and arrangement; he will then seek that information as a pleasant pastime, rather than as a branch of his education. The phenomena of plant life are far more important to understand in order to know the plant's necessities; why and how plants grow, how they feed and what they feed upon; the cause of failure as well as success. The gardener is the only man who knows how to develop a plant to its greatest perfection; how to improve upon old types and create new ones. He does not want to learn from the professor; on the contrary, he should compel the professor to learn from him. As a rule, professors are not scientists; they are simply the distributors of the facts termed "scientific," that have been obtained by the observations and experiments of other men. The scientific man is he who has discovered some fact not previously known, and can reduce it to practice. And among our systematic, intelligent gardeners more of such men will be found than in any other walk in life. Their operations are so varied that they come in contact with more obstacles that are to be overcome, than any other class of men. They are compelled from the very nature of their business to know more. The mechanic of today learns but a small part of one branch of his business, and this is being constantly repeated without the slightest variation. He is a part of a machine. The gardener must, in a great measure, be governed by the elements, which are very capricious; he must perfectly understand all the conditions of soil and climate and be governed accordingly. Impossibilities are not unfrequently required at his

hands and should he mention the elements as opposing forces, it would not always be accepted as a valid excuse for the failure of a crop.

While gardeners, through methods strictly scientific, have succeeded in producing more novel forms or types in vegetable, fruit, or flower than all other men, they rarely profit from it financially as well as they ought, because they are not systematic in business methods. They do not apply their gifts to their own profit; they let other men reap where they have sown.

Let us state a few facts in support of this assertion. Nearly every prominent seedsman in our country annually sends out some "novelty" in plant, fruit, vegetable, or flower. The seeds or plants of these are sold at no small profit. From whence does he obtain these valuable acquisitions? Invariably from the gardener, whose keen discrimination has detected some little variation in form, color, or marking of a flower; either a sport, a chance seedling, or perhaps the result of systematic cross-fertilization. He may have discovered a plant remarkable for its vigor, and with flowers larger, of more substance, and of a deeper color, than the type. He selects the seeds from these and, by careful, systematic selection, after years of patient, pleasant industry, establishes a type of superior merit. And what is the result? He shows the fruits of his industry at an exhibition and is justly proud of the certificate or medal he has earned. His favorite seedsman gets the stock for a mere song and creates a sensation by the introduction of a "novelty" and makes a good profit, which the gardener should share but rarely does. We have known very many instances of this kind; in fact have profited by them, and we can truly say that we do not know of an instance (and we have followed seed growing for many years) where a seedsman ever originated any one of the new varieties of vegetables or flowers which he has disseminated. It is the gardener, or agriculturist, to whom we are indebted for all that is valuable in the way of new varieties.

The same is true of scientific knowledge in its relation to plant culture, growth, or development. We are indebted to the gardener for all the facts pertaining to these subjects, which the professional scientists are teaching. Practical knowledge can be gained from no other source. If a man wants the real knowledge of plants, he must go to the garden and learn it of the plant. He

must be a gardener. It matters not whether he is to teach the art or practise it; the garden is the school and Nature the head teacher. However much the science may be disseminated afterwards, it is born in the garden and cradled by the gardener.

A man may be proficient in systematic botany; his herbarium may be complete; and yet he may not truly know orchids or onions. There is a great difference between *knowing a thing* and *knowing about it.* To *know* is to be educated; to *do* is to be scientific. A man is not necessarily a musician because he can render perfectly one of Beethoven's symphonies. He may be only a performer or imitator. A musician is he who has assisted in perfecting the modulation of sound. So too, a man is not a gardener who simply talks about the garden and describes the plants. He may know their names and origin without knowing *them.* He is not a scientific gardener who can repeat every word of some scientific treatise on gardening. The scientific gardener is the one who, through his own observation and industry, has gained some facts in regard to plants and their culture, or developed some forms, not previously known. He is a man who can make a garden and have in it all that is desired in the greatest perfection. Such gardeners teach our professors.

If a man should call upon one of the professors of botany or horticulture at Harvard, the fountain head of education, and make some inquiry regarding trees, he would soon be filled to overflowing with the contents of their text-books and he would very likely exclaim, "I do not want the tree in the abstract; I want it on the lawn, in the orchard, or by the roadside." The professor would then say, "if trees are what you want, go to the Arnold Arboretum and see Dawson. He knows them all; they sing for him and talk to him in their way. He knows their language because he is in sympathy with them. Every fibre of a tree is a musical chord that is in harmony with his nature. A seemingly lifeless branch will bud for him when it would not live for another." If a man wanted roses, he would be directed to Moore of Concord, or Wood of Natick. If chrysanthemums, he would be directed to Dr. Walcott. If orchids were desired, he would be told to visit Robinson or Allan. If he wanted lessons in landscape pictures combined with everything else relating to horticulture, he would be advised to take the first train for Wellesley and have a chat with Harris, who knows vegetables, fruits, flowers, as well as trees

of all kinds, and can make of them pictures with which, for real beauty, nothing in the way of art can compare. He knows all about them while we only know what he has done.

So much to show that the professor is dependent upon the gardener for scientific truths, and the gardener is entirely independent of the professor.

The gardener should be educated not only up to the times but far ahead. The plants of forty years ago have no place in the garden of today; while those of a hundred years ago may have, as novelties. Change, the universal law of Nature, is the order of the day. This is not due to fickle caprice, but is necessary to satisfy the increasing demand for the beautiful,—a demand that is imperative and exacting. Not that we tire of old forms or colors in the flowers, or the delicious qualities of our vegetables and fruits; but the spirit of progress which marks this era is reaching far and wide for the perfection in development that knows no limit. This spirit should stimulate the gardener to more constant, systematic, and noble effort in his profession. It is to him and to him alone that we are indebted for the garden of today in contrast to that of fifty years ago. In this country, flowers were then regarded as luxuries; today they are necessities. The desire for a good garden is now so nearly universal that the exception only proves the rule; and there can be no gardens without gardeners. Some of the best—at least the most enthusiastic—are amateurs, and to them we are largely indebted not only for the improvement in floral forms but for the development of taste that makes gardening a profitable profession. Though amateurs, many of them are wealthy, but still they are gardeners if they love and work in the garden, and if there is one influence more powerful than another in removing that distinction in society which wealth creates, it is a love for and a common interest in the beautiful. This love united with other elements of character, will bring into harmony all classes of men having congenial tastes, and cause them to become warm and congenial friends. These signs of human equality rarely appear in any other walk in life. There is no bond of affection between a merchant and his clerks, manufacturers and their employés, such as is frequently seen between the owner of the garden and the toiler in it.

The gardener, whether private or commercial, should always be on the alert for something new. His success will be proportioned

to his development of new and rare forms. He who introduces a new rose, if it has merits not already possessed by others, and if it be the result of the labor of his own head and hands, has established an enviable reputation which is quite as important, in a business way, as the direct profit that will accrue from its introduction. There never was a time when wealth contributed so liberally to taste as the present. Any new floral form, of merit, is eagerly sought and liberally paid for; it matters not whether it be superior to existing forms — if it has distinctive characteristics it will find a place in every garden and add to the fame of the originator.

But the old should not be neglected for the new. The perpetuation of old varieties is quite as important as the development of the new ones and, perhaps, more so. All depends upon the skill of the gardener in getting from the plant all that it is capable of producing. There is, oftentimes, more difference between a variety perfectly developed and the same neglected, than between an old and a new, though similar, variety. The scientific gardener will make the old appear as new because of perfect culture, while the unscientific gardener will make the new appear old from carelessness and neglect.

System, which carries with it order and neatness, is a good working capital for any gardener. A neat garden is almost invariably a good garden, and the manager of such an one is sure to be successful. The plants he grows will bring twice as much in the market as those from the sloven's hand. All that makes a plant valuable is its beauty, and beauty is never associated with filth. I would, therefore, urge every gardener, amateur or professional, private or commercial, to encourage and stimulate a love for the beautiful; it is an antidote for all the asperities of life; it softens the hours of labor and sweetens the acerbities of our natures. A study of the beautiful, whether in the plant, the tree, or the flower; whether in the conservatory or the vegetable garden; in field or wood; in fact wherever found, will have a tendency to elevate and strengthen and refine character and materially assist in promoting happiness. The gardener, more than any other man, is a child of Nature, whose gifts, united with his industry, his experience and observation, will make old age beautiful and pleasant. The love of the beautiful never wearies nor grows old; on the contrary it increases with our years.

When the active duties of life are over, the gardener has a rich fund of enjoyment and constant companionship in the plants he loves.

I would say in conclusion that financial success in life is within the reach of every gardener who will truly and nobly seek it. There is room and opportunity for all. There is abundance of work for those who are anxious to find it. Our country is broad and rich and made richer every day by those who are willing to work. A small business can be started with but little capital other than energy, industry, and intelligence, united with sound morality, that will rapidly elevate a man to a comfortable and honorable position. The lower walks of horticulture may be full to overflowing, but in the language of your great statesman, "There is plenty of room up here." In this country, where men are measured by their worth, and not by the accident of birth, distinction only comes to those who work for it, and there are no men more likely to reach it, than well-informed, honest, and industrious gardeners.

Discussion.

F. L. Temple asked what ought to be done to stimulate the production of new varieties of hardy trees and shrubs. He thought the efforts to improve our stock of plants have been for a long time directed to bench or bedding plants almost exclusively, and he felt that there is need of a change to things of greater permanence, which are far more valuable than any other class of plants.

Mr. Allen said that through this country young people are mostly uneducated in regard to plants, and until they are properly instructed in this direction, knowledge and taste in relation to these things cannot become general. Today the followers of fashion in New York would as soon wear a cauliflower as a Cattleya, if it were only fashionable. A man came to him once with a large order for forced ox-eye daisies, and willingly paid seventy-five dollars per day for three weeks, during which time the supply was furnished. It was merely caprice which made the flowers valuable. As soon as the people become educated to see something beautiful in plants besides color, trees and shrubs will be better appreciated. In the old countries, they cultivate old flowers because they love them. Plants that were pictured in

1612, are just as much prized over there today, as they were in those old times. When the people are educated aright they can see as much to admire in a well grown plant, even without a bloom, as in a fine flower.

Jackson Dawson remarked that a new plant receives the same expression of approval from this Society, if it shows any superiority over the older varieties, whatever class it may represent. He wanted to call attention to the greater length of time required to get satisfactory results when one attempts to produce a new and decidedly superior rhododendron or other shrub, and especially a tree, compared with the time required in such attempts with herbaceous plants, and particularly with annuals. In the former case the work covers a term of from three or four years to perhaps ten years, while in the latter one year may complete it. But, on the other hand, the bedding plant is in perfection in a year or two, while the shrub or tree will not only continue many years, or perhaps a lifetime, but will increase in beauty and value every year. Moreover this work must be done by a person who has had a thorough training in gardening operations, and who has a natural taste for such work. Societies do not look at these things from this point of view, and, therefore, do not appreciate them as they deserve.

Mr. Allen agreed with Mr. Temple's view, that the Massachusetts Horticultural Society should recognize plant values in proportion to their cost. He added that he should like to live to see the time when the producer of a valuable new variety of tree or shrub — a choice azalea for instance — will be paid liberally for the skill and knowledge as well as the time devoted to bringing it out.

Mr. Temple thought that the horticultural societies of this country had, during the past twenty-five years, given too much of their attention to the improvement of annuals and greenhouse plants, and too little to the production of better trees, shrubs, or permanent things generally. He believed that these societies had lost influence by that course. There is no firm in this country doing the work for us that Lemoine is doing in France, or John Laing in England. Almost nothing is done here to encourage effort in that direction. All can see fine roses, and many appreciate them; but hardy things of high value are either not seen, or if seen are not understood. But few prizes and those small are

awarded to things in this line, and many really choice plants are consequently allowed to go back to oblivion. This is not a personal matter, but it is an important one to the country at large. This work requires the possession of great knowledge and judgment, the result of long and peculiar education, and where it is already acquired it should not be permitted to pass away and be lost through lack of due appreciation and encouragement.

Leverett M. Chase said he had been many years a teacher of boys. He had tried to induce them to experiment with fruits, for the purpose of producing new and better varieties, especially pears, and most of them enjoy it. He thought it desirable that more of us should take up this work, both in fruits and many other hardy plants. They have been too much neglected. The study necessary to prepare for it should be introduced into the schools. Now, happily, it seems probable that something may be done in this direction; at least the prospect is better than heretofore. He would like to see, in Horticultural Hall, monumental tablets to commemorate the services, and to honor the names of such noble discoverers, or producers, of good things as E. W. Bull, the originator of the Concord Grape, and Francis Dana, that single-minded, earnest seeker after better fruits, who produced so many choice varieties of pears. We should recognize and honor such laborers for they are benefactors of our race. We should not take the fruits of their study and toil as matters of course — which may not yet be styled robbing them — but should show appreciation by rewarding them.

President Spooner, called attention to two hardy plants, *Viburnum plicatum* and *Andromeda speciosa*, which were brought in from the Arnold Arboretum, and exhibited in bloom today, by Jackson Dawson, the gardener there, who is doing more than any other person to bring out the beauty and other desirable qualities of hardy trees, shrubs, and vines, and to make known their availability for garden, lawn, or park adornment.

John C. Hovey considered annuals and bedding plants as valuable as shrubs. A great advance has been made in these plants; new ones have been introduced and many new varieties have been produced, and most old sorts have been improved. We all know that asters and zinnias, geraniums and other bedding plants are invaluable for decorative purposes, as we see in the Public Gardens, at Mr. Hunnewell's country seat, and other similar

places, and no hardy trees or shrubs could possibly serve as substitutes. Moreover a large variety of bedding plants bloom all summer, while shrubs, with few exceptions, are in flower only a short time.

Mr. Temple did not mean to say that too much encouragement was given to the culture and improvement of bedding plants, but that too little had been given to efforts applied to hardy trees, shrubs, vines, etc. When he spoke of cheap annuals, he meant only those which are easily grown, and require little knowledge or skill.

Mr. Hovey believed that everybody could grow annuals.

William C. Strong said that it is natural that plants which are easily and therefore cheaply propagated should be more prominent in commerce than those propagated with difficulty. Also that, as compared with trees, shrubs would be much the same. That this is the case, is not so much the fault of the Society as of dealers, who every year make a specialty of the trade in quickly grown plants. He did not think this Society had been remiss in its duty, nor even backward in its encouragement to growers in any department. It has been accustomed for a long time, to offer Prospective Prizes to the originators of improved fruits and vegetables, and these have been productive of fairly good results. He thought it would be well for the Committee for Establishing Prizes to consider the propriety of giving additional encouragement to the production and introduction of new varieties of ornamental trees and shrubs. It certainly is a much slower process to obtain these, than a new seedling strawberry, for example, and the introducer of these should receive proportionate encouragement. The speaker said he was in full accord with the essayist in regard to the honor and dignity of the gardener's profession. Old gardeners are held in honor in England. This is relatively a new country, but it is only right that we should desire our gardeners to be as well trained, and be held in as high esteem and honor as those in the old countries. A thoroughly trained and accomplished gardener should be regarded as one of the family or of the firm, for he is, properly, a most interested party to the progress and success of the estate or the establishment with which he is identified. But there is an influence in our country which leads men who have ability, to think they should use it in some purely money-making scheme, or occupation.

Robert Manning referred to the establishment of an Experimental Garden, at Mount Auburn, by the Society, and said that, in connection with it, General Dearborn, the first President, had planned an "Institution for the Education of Scientific and Practical Gardeners." The course of instruction was intended to cover three years, and to embrace the sciences of Botany, Vegetable Physiology, Chemistry, Mineralogy, Architecture, Hydraulics, Mechanics, Entomology, and such other branches as are applicable to Horticulture, the culture of fruit, forest, and ornamental trees, shrubs, flowering plants, culinary, and such other vegetable products as are employed in the industrial arts; also training in the composition of landscape and picturesque gardens. Although this portion of the plan was never carried out it showed the comprehensiveness of General Dearborn's views of horticulture that he should have devised such a plan.

In answer to an inquiry as to how far the Experimental Garden progressed, Mr. Manning said that at the close of the year 1832, General Dearborn reported that the garden had been laid out, the paths and avenues constructed and bordered with turf, and that the whole would be in readiness for planting fruit and ornamental trees in the spring. In May of the next year he reported that under the direction of Mr. Haggerston, the gardener, more than thirteen hundred fruit, forest, and ornamental trees had been planted, and hot-beds had been prepared, and that among the seeds sown were four hundred and fifty varieties which had been sent to the Society from Europe, Asia, and South America. The reports of the meetings and exhibitions of the Society during that and the next year, show that plants of vegetables were sent to the Society's rooms for distribution to the members, and that a considerable variety of flowers and vegetables were exhibited. When the establishment at Mount Auburn was disposed of the garden was necessarily given up, but this was regretted less than it would otherwise have been, had not the experience of two seasons shown that the soil was not adapted for an experimental garden.

J. W. Manning referred to the Bussey Institution as the greatest object lesson in America. It is a place where one can study hardy tree and shrub growth from the originals, as the collections include many forms not found elsewhere in this country, and not in nursery catalogues. He mentioned as among other things, that the apple is seen there with fruit which attains only the size of

small currants. These small apples were doubtless the original apples, proving that the sin of Adam and Eve was based on the eating of very innocent looking small fruit, and also that we still have the means of original sin. He added, however, that both apples and sins have since grown larger as conditions admitted.

On motion of O. B. Hadwen a vote of thanks to Mr. Allen for his very interesting and instructive paper was unanimously passed.

The Chairman of the Committee on Publication and Discussion announced that on the next Saturday, Thomas C. Thurlow, of West Newbury, would read a paper entitled, "A Plea for Protecting Our Native Birds."

BUSINESS MEETING.

SATURDAY, March 21, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

The President announced the decease, at Indianapolis, Indiana, on the eleventh instant, of John B. Russell, the last survivor of the founders and corporators of the Society. John G. Barker moved that a committee of three be appointed by the Chair to prepare a testimonial to the memory of Mr. Russell. The motion was carried and the Chair appointed as that Committee, Mr. Barker, C. H. B. Breck, and Robert Manning.

Adjourned to Saturday, March 28.

MEETING FOR DISCUSSION.

A PLEA FOR PROTECTING OUR NATIVE BIRDS.

By THOMAS C. THURLOW, West Newbury.

It is said of the Pilgrim Fathers that, during the first long and severe winter in this country, their hearts often failed them, and they more than once decided if they lived till spring to take ship and go back to the mother country, leaving this cold, bleak coast in the undisputed possession of wild beasts and savages. The fickle

climate, so different from that of England, so confused their minds that they more than once supposed spring had come, only to be disappointed by the return of winter in a more dreadful form, until hunger and exposure had laid more than half their number beneath the sod. At last, we read that their hearts were made glad, for "The birds sang in the woods, and there was a steady rain," and then they knew that spring had come, and they "thanked God and took courage." Not one of them it is said returned to England, but on the contrary, as spring advanced and the birds increased in number and variety — as the wild trees blossomed in the woods, and hill and vale were fragrant with the breath of flowers, they speedily forgot — and no wonder — their troubles and the sorrows of the winter, and when June came — the New England June, which no country on earth can equal for loveliness and beauty — then was their cup of joy full; and instead of writing to their friends at home of the terrible winter they had just passed through, their letters were filled with such glowing descriptions of this new world, that many, very many, were induced to come over to these rugged shores, the result of which we are all perfectly familiar with. Now this is my first plea for the birds. If this band of despondent fugitives was so cheered and encouraged by their loving and happy songs, shall not we, their descendants, inherit this same love for the birds which bring us the first tokens of returning spring, and the first assurance of milder and more genial skies? What country child but is thrilled with joy and ecstasy at the first sound of the bluebird, returning from his southern home, or the familiar peep of the dear old robin, as he hops about our yards or flies from tree to tree, telling us in unmistakable language how glad he is to return, and stop with us another season? And later on, what farmer's lad does not stop in the furrow, to watch the shining blackbird, stepping proudly on the upturned soil, or to listen to the song of the thrush as he tells him it is time to "plough, harrow, plant, and pull it up?" A little later, what child of any age is not enraptured and amused at the incomparable song of the bobolink, as he rises in the air perfectly intoxicated with mirth? And last of all, the low, plaintive notes of the cuckoo tells us that the hot days of summer are upon us, and we must be up and doing. It does appear, that if we, as a nation, need the presence of the American Eagle to remind us of our country's greatness and power, and the children in our schools

are to be constantly reminded of the stars and stripes to teach them patriotism and the love of country,—that the love and care of our country's native birds, should fill the young mind not only with a love of country, but also with a desire to be kind and loving and good.

In the second place, the usefulness of birds, in destroying insects, is established beyond a doubt. Experiments to prove this have been made over and over again, and no intelligent, observing person can deny that our common birds devour myriads of insects, which if left unmolested would increase, as the season advances, to an alarming extent. Many of our birds, during the spring months, live entirely on insects. Some of these insects, such as moths and millers, are captured on the wing; others in the larva or chrysalid state, and still others as they appear in early morning as worms, grubs, borers, etc. Those birds especially, classed as Insessores or perchers, and Scansores or climbers, are all insect-eating birds; but may later in the season take a little fruit or grain as a dessert. Those classed as Raptores or robbers (including owls and hawks) subsist partly on insects and reptiles, but the damage done in killing other useful birds, is probably greater than all the good they do. Other native birds, such as the waders, swimmers, and scratchers, are commonly classed as game birds, and although it is positively stated by ornithologists that many of these birds subsist largely on insects, still the laws are against them, and they are protected for certain months, in order that sportsmen may have the pleasure of killing them during the remainder of the year. Supposing they do live wholly on grain and seeds, as some obstinately assert when asked not to destroy them, then the farmer has the honor of fattening them in his grain fields, in order that the "city chap" with dogs and gun, may have the "sport" of tramping through his fields and pastures to shoot them.

For several seasons, a flock of quails has visited our home, and during the summer have become so tame that we could whistle them to within a few rods of the buildings. Every one on the place treated them as they would a flock of tame chickens, and they were permitted to run through the garden and nursery unmolested; but they are spotted and after a certain day in October, are killed by the sportsmen. We try to protect them, but "rainy days and Sundays" are generally taken by those who destroy them. Within my remembrance, the marsh birds have been quite

plenty on our coast between Cape Ann and Hampton, but now it is a rare thing to see a yellow-leg, plover, snipe, or sandpiper. In the meantime the grasshoppers have increased, as the birds have decreased.

I am told that in the State of Illinois the laws are such that there is a heavy penalty for killing a prairie chicken or quail until a certain day in the fall, and that no farmer or farmer's son is allowed to kill any of these birds, even on his own land, till the day arrives, when the sportsman, ever on the alert, speedily secures the birds which have been fattened by the farmer. As a result, grouse, which were formerly plenty in several of the Western States, are disappearing like the buffalo on the plains, and it will soon be known only by picture.

It is a singular fact that the game laws of this country generally favor the sportsman, and more singular and painful still, that some of our agricultural and horticultural periodicals should cater to the sporting gentry, and even recommend planting certain trees and shrubs for parks and game preserves. I have not had time to inform myself fully on the present game laws of Europe, but my impressions are that, years ago, the German government, thinking the birds destroyed their fruit and grain, recommended the promiscuous killing of all birds; but in a few years the insects so increased, as to threaten the destruction of all their crops, and strenuous laws protecting birds were at once made, which continue in force at the present time. If I mistake not, Spain has learned that the destruction of her forests has so diminished the number of birds, that great losses to crops have resulted. I will not pretend to say that if the birds had all been permitted to live there would have been no damage done by insects; but it must be admitted, that at the settlement of this country, when the primeval forests protected thousands of birds which now have no such protection, nature preserved the balance of power, and birds and insects must have lived together for generations without either gaining materially on the other. Since that time, no new species of insects have been created, though some have been imported; but through the the cutting off of our forests, the converting of immense tracts of wild land into corn and grain fields, and the multiplication of vegetable and fruit farms, the balance of power has been turned in favor of the insects, till today the formidable host is the terror of all agriculturists throughout the land.

Dr. Harris in his work on Insects, in speaking of canker-worms says: "But since our forests, their natural food, and our birds, their greatest enemies, have disappeared before the woodman's axe and the sportsman's gun, we are left to our own ingenuity, perseverance, and united efforts, to contrive and carry into effect other means of checking their ravages."

Of the English sparrow, I can say nothing from experience. As our place is somewhat retired these foreigners have never visited us, and with my present convictions I do not regret their absence. Without doubt they were introduced from purely philanthropic motives, but would it not be well for our government to establish a wise and prudent commission to prevent such mistakes as the importation of noxious weeds, the English sparrow, and the gypsy moth? Of other birds I can speak from experience. Our house and out-buildings are every year at the service of large flocks of chimney, barn, and eave swallows; the pewee and robin rear their young with all confidence under the covings and brackets of our house; the bluebird looks every spring for her box in the apple tree; the oriole, the cat bird, and the thrush, all build in their own chosen spot within easy call of our home, and the sparrows have become so domesticated that they daily look for food within a few feet of our doors. As a result the tent-caterpillar is fast getting to be a thing of the past on our place; the canker-worm has nearly disappeared, and the cut-worm and the June-bug, formerly abundant, are now seldom seen. An abundance of evergreens and hedges about the place, while they serve to beautify the landscape, and form barriers against winds and cold, become a retreat for birds in which to build and rear their young, comparatively safe from the attacks of their enemies. Piles of brush, left in the pastures and orchard, although presenting a slovenly appearance, are the places generally chosen by the thrush, and often by the cat bird and robin. One serious obstacle in discussing this subject as we do today, is the prevailing, and, I fear, of growing, opinion that these same birds do more injury by eating fruit, than they do good in destroying insects. I have met in a fruit growers' meeting, apparently intelligent and observing men, who would declare that the robin was a nuisance and a thief and deserved extermination. I am aware that a flock of birds will often despoil the fruit on some favorite early pear, cherry, or peach tree and that a few Delaware grapes, currants, or raspberries will quickly disappear, but the

extensive grower of small fruits, cherries, or pears, will find very little, comparatively, destroyed. My father formerly raised over a hundred bushels of cherries annually. No perceptible damage was done by the birds, except to the earliest and latest in ripening. We always expected the birds to eat what they wanted, and never thought of frightening them from the trees. Why this great outcry against the robin, I cannot tell, but with your permission will quote briefly from others who are high authority.

Mr. Samuels, in his "Birds of New England," in speaking of the robin says: "Perhaps none of our birds are more unpopular with the horticulturists than this; and I will give the observations of different scientific men, and my own, to show that the prejudice against the bird is unjust and unfounded."

Professor Treadwell, of Cambridge, reports: "The food of the robin while with us, consists principally of worms, various insects, their larvæ and eggs, and a few cherries. Of worms and cherries they can procure but few, and those during but a short period; and they are obliged, therefore, to subsist principally upon the great destroyers of leaves — canker-worms, and some other kinds of caterpillars and bugs. If each robin, old and young, requires for its support an amount of these equal to the weight consumed by this bird, it is easy to see what a prodigious havoc a few hundred of these must make upon the insects of an orchard or nursery."

Further on, Mr. Samuels says, "Wilson Flagg, an acute and careful observer of the habits of our birds, gives some of his experiences of the robin, as follows. He says, ' . . . the more I have studied his habits, the more I am convinced of his usefulness. Indeed, I am now fully persuaded that he is valuable beyond all other species of birds, and that his services are absolutely indispensable to the farmers of New England. Some persons believe that the robin is exclusively a frugivorous bird, and that for fruit he will reject all other food that is within his reach. Others believe that his diet consists about equally of fruits and angle-worms, but that he is not a general consumer of insects. The truth is, the robin is almost exclusively insectivorous, and uses fruit, as we do, only as a dessert, and not for his subsistence, except in the winter, when his insect food cannot be obtained. He is not omnivorous like the crow, the jay, and the blackbird. He rejects farinaceous food unless it is artificially prepared, derives almost his entire

support from insects and grubs, and consumes, probably, a greater variety of species than any other bird. I am entirely at a loss to account for this very prevalent and mistaken notion respecting the frugivorous habits of the robin.'"

There is also a prejudice against many other insect-eating birds, though it may not be as strong as that against the robin. The oriole has been accused of eating green peas. The cat bird and thrush have been known to eat raspberries; and some farmers shoot the red-winged blackbird and hire boys to break up their nests, because they say they have been caught in the very act of pulling up a hill of corn. But alas for the poor bobolink! I have heard it positively asserted that these birds would destroy the whole rice crop of the south, unless active measures were taken for their destruction. There is no doubt that large flocks of these birds have been known to hover over and light down upon the rice-fields; but I cannot but think that the amount of damage done by them has been greatly exaggerated, and would kindly suggest to our Southern friends that this whole matter be carefully examined, to see if the damage done by the host of constantly increasing insects is not very much in excess of that ever done by the birds. One thing is certain; if something is not speedily done to prevent the wholesale destruction of this, and several other species of birds, they will in a few years become entirely extinct.

I will try to name, as briefly as possible, what are some of the *enemies* to our small, or insect-eating birds. The common crow, in my opinion, does more damage by destroying the eggs and young of other birds, than he does good in devouring a few insects. I have watched him for years, and have seen hundreds of robins' and other birds' nests destroyed, the eggs eaten, and the young taken away. Hence the robin has learned to seek shelter near the habitations of men. Last season a crow came into a small tree not three rods from our house, and killed two out of a nest of young robins, before he could be frightened away. I would recommend that all crows' nests in the vicinity of our farms be destroyed, and perhaps, also, that the state offer a small bounty on his head, as is done in other New England states.

I am sorry to believe that the beautiful jay is often guilty of the same mean business. Cats are useful animals, if well treated and trained, but a superfluity of uncared for, hungry cats, is a very great nuisance, and often destructive to young birds. Owls and

hawks, if plenty, will kill small birds; therefore keep them at a distance. The red squirrel is destructive of many species of young birds, and I should advise shooting them every time they are seen. The increase and improvement in fire-arms, has proved a temptation to many a man and boy, who for a few dollars can now buy an improved breech-loading gun, such as few of us ever dreamed of forty years ago. Unless educated to the contrary, thousands of school-boys will thoughtlessly indulge in this exciting sport, causing the destruction of vast numbers of birds every year. It may be necessary to kill a few birds for the cause of science, but it is to be hoped that no taxidermist nor any other person will indulge in this sport for mere profit, or their own gratification.

But saddest of all is it, that in this Christian and enlightened age, thousands of beautiful little singing birds should have been slaughtered to ornament ladies' hats and dresses. What a blot upon our times for the future historian to record. But a gleam of light is breaking, when the Princess of Wales, with noteworthy courage, gives orders "that nothing need be submitted for her inspection, or that of her daughters, in which birds are used as trimming," and it is to be hoped that this noble example will be followed everywhere, especially in our own country, where everything "English," whether good or bad, is copied so quickly by our own people.

But by far the most alarming thing at the present time, is the practice, in some of the Southern States, of killing these birds during the winter for game. Last summer, a lady assured me that over a bushel of robins were brought one day, into the hotel where she was stopping, and served up for dinner; because she declined to taste them, the remark was made, — "That is all these Yankee birds are fit for." My neighbor who spent the winter in Florida two or three years ago, says he was offered twenty-five cents each for robins, at one of the large hotels. I believe most of the northern and middle states have laws to protect useful birds, but it is useless to protect and foster them at the north, to be killed in winter at the south.

It is very evident that the time has come, when there should be strong and effectual national laws for the protection of our birds, and also that we should have the sympathy and coöperation of all adjoining countries and islands.

This Massachusetts Horticultural Society has enjoyed a long and honorable record; whatever it advises and endorses commands the attention and respect of the whole country. What better record could we make today, than to pass a resolution advocating and approving of strong and effectual national laws for the preservation and protection of all our insect-eating birds; also asking the coöperation of all kindred horticultural and agricultural societies, to help on this good work. Such an influence brought to bear from all quarters upon our representatives in Congress, might speedily bring about the desired result.

Discussion.

President Spooner in calling for remarks upon the subject of Mr. Thurlow's paper said it was one of the most important that could engage the attention of horticulturists, and he hoped there would be a free expression of thought upon it.

Rev. Calvin Terry said he loved the birds, and had always loved them from his childhood. When a small boy he knew all the kinds in the region round, and knew their habits and their nesting-places; he could interpret their songs or notes, and imitate them so that they would come at his call. But he grew up with prejudices, derived from older people, concerning many birds, and classed them as mischievous,—wrongfully as he had since learned, for his observations had taught him to drop one species after another from the black list, till now but very few remain on that list. It is true, as the poet says in the old school books, that "kites, hawks, and owls deserve their fate," but not so with the warblers around our homes. There is not much for us to do in destroying the native birds in order to check their too great increase; Providence has taken care of that, for birds destroy other birds, their eggs, and their young; and cats are worse than birds as destroyers, so that their number is kept quite uniform. From lack of close observation, people are often mistaken in their opinion as to the mischief birds are doing. The brown thrush, the crow-blackbird, and others are charged with pulling up corn, when, in fact, they are digging for grubs, cut-worms, etc., which are bred in the stable manure placed in the corn hills at planting time. They may bite off or pull up a little corn, but the holes made in the ground are oftener those made to get the worms. As to the crows, bounties have been paid for their destruction because of

the mischief they do in the cornfields. They are really the most useful birds we have; they are great scavengers; they carry off every dead snake, frog, and mouse—every kind of carrion, which would breed pestilence were it not thus removed. And as to pulling up corn, they can be educated out of that. The speaker said that they do not pull up his corn, and have not for thirty years. When he first came to the place where he now lives they pulled up his corn some, but he taught them better. Generally they do not pull up much except in a very cold, rainy day, when they will do more harm than in an entire week of fair weather. But just set a steel-trap baited with a rotten egg and catch one of the crows, and all the crows in the region will see it, and shun that field, especially if you hang up the dead crow in the field.

He has in his home a painting made by the artist of the family, representing a venerable crow, slightly gray, holding in one foot a wild turkey quill pen, and standing upon a large, dilapidated book, such as were made two or three hundred years ago. The idea of the artist was to represent an ancient historian, with his record of colonial times brought down to date. The crow is a very bright and wise bird, long-lived—a century or more—and could it speak our language it could doubtless tell us many things which would be interesting to hear. A little back of the speaker's house is a grove of evergreen trees, in which are the homes of about eight crows all the year round. Alike in summer and winter their cheerful notes ring out even when no other living thing can be heard, making the gloom of winter brighter. There they build their nests and rear their young every year; but though he never knew of any person destroying a nest or killing a bird, the number remains the same from year to year, the young, probably, being sent away to colonize other regions, while the parent birds remain. These, daily, and especially in winter, fly over to the beach to feast upon dead clams and other refuse from the sea.

Mr. Terry's observation as to robins is that they feed, not upon insects as the essay has it, but upon earthworms, angle-worms, cut-worms, etc. True they take some cherries, and where there are but few grown they will take all; but if there is a great abundance they will not seem to diminish the quantity much, and as a Connecticut writer says, "Who can grudge them a few cherries as a relish with the worms they destroy for our benefit?" And who can describe their waking-up carols in the first blush of

a May morning! In his experience the cat bird is a much worse cherry thief than the robin, and the oriole is bad. But none of the birds are as bad as the mischievous boys and girls (some of even larger growth) who break off the branches and damage the trees in their efforts to steal the fruit. There is great need that these should be educated to better things and ways in relation to their neighbor's fruit; and also as to the destruction of our valuable birds.

Yesterday the speaker heard the cheery notes of the bluebird and phebe, and this morning a quail whistled near his home, saying "Spring has come!" They are better indicators of the seasons than is the weather bureau at Washington.

Mr. Terry had a little story about the crow, and as his children used to say, "tell us what you know yourself, then we shall know 'tis true," he would relate it. When he was a small boy there was a tame crow in the village, which was allowed free access to the houses, kitchens, parlors, sitting rooms, etc., and it became a great thief and nuisance, carrying off thimbles, spectacles, spoons, scissors, etc. He himself had a brood of eleven young chickens. One day as he went to feed them there were only two alive; the little feet and other remnants of the rest were lying around to tell their fate. The next day that crow came again to finish the brood. Now it wore a *red feather*, taken from a military cap, directly over its crop. Mr. Terry took his little gun and just put a shot through that red feather and that crow did not steal any more spectacles or chickens. And he heard that the good women in the village said he deserved universal commendation. The moral of this story is that crows, as well as all other creatures — men and women included — should be kept in their proper spheres as Nature ordains by her laws.

Francis H. Appleton said the subject under discussion was brought before the Massachusetts House of Representatives last year, and the result of its consideration was the adoption by that body, on May 28, 1890, of the following resolution:

Resolved, That the Board of Agriculture of Massachusetts be and they are hereby requested to make inquiry and investigation as to the birds that inhabit the State, and report thereon as to their character, habit, and value as insect destroying and grain and fruit destroying birds, and advise on such legislation as may be necessary for the protection of private and public interests.

In accordance with this resolution, the Board of Agriculture employed Dr. B. H. Warren, State Ornithologist of Pennsylvania, to prepare and deliver a lecture on the birds of Massachusetts, at their public winter meeting in Worcester, December 3, 1890. This lecture and the lengthy discussion which followed it will be found in the report of the Board of Agriculture of Massachusetts for 1890. In addition, the Board, by its Secretary, made careful inquiries of intelligent persons in our own State, and corresponded with ornithologists in other States and foreign countries. As a result they reported that, as a whole, the native birds of Massachusetts are benefactors. The small losses occasioned by the raids of some species upon our fruit trees, gardens, grain fields, and poultry yards are repaid many fold by the benefits resulting from the destruction by them of injurious insects, field mice, and other vermin that are a detriment to agriculture. It is, however, the opinion of ornithologists that crows cause a greater loss in the cornfields, and by destroying the eggs and young of useful birds, than they are capable of repaying by the exercise of their good qualities. But most of our birds of prey, as hawks and owls, by their services in the destruction of field vermin, are thought to more than make good all damage they cause in the poultry yard and otherwise.

The English sparrow, (*Passer domesticus*) was the subject of extended inquiry, and it seemed well substantiated that its character is wholly bad, and that it should be exterminated. This led to the consideration of methods to secure that desirable object. The system of state bounties was quite fully discussed in Dr. Warren's lecture, and thoroughly condemned, as an utterly futile expedient. He quoted many facts from reports of investigations made in Pennsylvania, which proved that great frauds were successfully practised under the bounty law of 1885, styled the "Scalp Act," under which about $150,000 were drawn from the public treasury, as bounties for the destruction of wild-cats, foxes, minks, weasels, hawks, and owls other than the saw-whet (*Nyctea Acadica*); the rate being two dollars for each wild-cat, one dollar for each fox, and fifty cents per head for all others. Their investigations convinced the inquiry commission that about $80,000 of this money was paid for the "scalps and ears" of hawks and owls, and mostly of species more beneficial than harmful. Furthermore, the ignorance of officers who disbursed the money, in many cases subjected

them to most barefaced frauds, as it was shown that among the scalps of birds brought in, and for which the regular bounties were paid, there were "heads of common domestic fowls, partridges, cuckoos, and butcher-birds; and, strange as it may seem, even two heads of English sparrows, which the officers were made to believe were heads of blood-thirsty, fowl-devouring hawks or owls." "In one county upwards of two thousand dollars were paid to a party of hunters for a mule's skin and a buffalo robe, which were cut into pieces and 'fixed up' so that they passed for 'heads' or 'ears' of predatory mammals, or possibly the wise (?) magistrate accepted a portion of them as the heads of hawks or owls." Also "a red fox was slain in one of the mountain districts, and its pelt was cut into sixty-one parts, from which, it is stated, the enterprising hunters realized sixty-one dollars for their work. Birds of prey, as well as other animals on which bounties were allowed, were shipped to Pennsylvania from neighboring states; in this way large amounts of money were fraudulently obtained. As one instance, Crawford County, one of the western districts, joining the State of Ohio, paid over ten thousand dollars, and of this sum it is said about seven thousand dollars were paid for hawk and owl heads." Dr. Warren, in connection with Dr. C. Hart Merriam, Ornithologist of the United States Department of Agriculture, "carefully examined the contents of the crops and stomachs of over three hundred and fifty hawks and owls on which bounties had been paid." They found that "ninety-five per cent of the matter consisted of the flesh of mice, other destructive quadrupeds, grasshoppers, and many injurious beetles." This was done early in 1886, and this evidence, in addition to that of the many frauds perpetrated, caused the repeal of the bounty law of 1885. Dr. Warren recommended that permission be granted for poisoning the English sparrows during the winter season, when nearly all of our native birds are absent.

Mr. Appleton stated that the present legislature have under consideration the establishment of a commission, to meet a like commission from each of the other states, for the purpose of concerting measures which would, if adopted by all the states, secure, throughout the country, uniformity in methods of dealing with the subjects which should be brought before this joint commission and reported upon by that body. He suggested that, as the English sparrow has become a recognized evil in all the more thickly settled parts

of our country, the question how to exterminate it might possibly be referred to this commission if, as is now hoped, it is established in the near future.

Edmund Hersey's experience had in the main been different from that related by Mr. Terry. He never has any trouble from the crows. As long as he treats them well they treat him well. He generally "lines" his field, and they build their nests within ten rods of the cornfield. One year his corn was quite near the house, and one morning he felt sure the crows were there pulling up his corn. He therefore killed one, but upon examination was convinced that he was mistaken. However, the dead crow was hung up in the field, and lines strung around the whole area. Notwithstanding these supposed preventive arrangements the crows came and pulled up corn, even within a few feet of the dead crow. Mr. Hersey could not understand why they did so, unless they believed that having the name of doing it they might as well have the game; or that they reasoned as some human beings do and pulled the corn to avenge the death of their comrade.

J. W. Manning believed that crows possess the gift of communicating ideas to each other. He knew of a case where crows were poisoned with arsenic because they had pulled up corn, and dozens of them died. No crows pulled up corn on that farm again for five years. When crows came there later it was believed they were either of a strange race, or of a generation so many removes from the original mourners as to have lost respect for the tales or traditions of their ancestors.

Leverett M. Chase regarded the crow much as the old deacon did his young wife—"Not a very great saint but a mighty fine little sinner." He had tamed two of them and found them most delightful and interesting pets—bright, intelligent, and teachable, but busy thieves. The crow seems more human than any other bird, especially in his vices—avariciousness, suspicion, greediness, cruelty—and in one case he had observed a sad inebriate. He had long made our native birds a study and believed that with one exception they do far more good than harm. Their preservation is well included among the interests our Society was founded to foster and advance; for their destruction means the destruction of our fields, forests, and gardens. As birds grow fewer, the labors of the husbandman increase, and the rewards diminish.

Losing our birds means not alone the loss of the jewels of the landscape, beautiful in form and color, — not alone the exquisite melody, so harmonious and sweet that good Saint Isaac Walton exclaimed, "Lord what music hast thou for saints in heaven, when thou hast such music for bad men on earth!" Not alone examples of conjugal affection, sacrificing parental devotion, gratitude, cheerfulness, intelligence, architectural skill, — not alone are the finest sensibilities outraged; we suffer in physical comfort, financial advantages, and in our general well being. Forty years ago one could see a thousand birds while taking a summer drive; now we may travel miles and not see a bird, unless it be the pestiferous English sparrow.

The poor innocents have indeed found this an unkind world and are fast disappearing before the birds and beasts of prey; the boys and men armed with breech-loaders; the destruction of our forests; the electric wire and lights; the pot-hunter and market man, and — worst of all — Christian women ruled by the dictates of thoughtless, ridiculous fashion. The Audubon Society of New York finds that more than 25,000,000 of our most beautiful birds are annually slaughtered, their skins stuffed with arsenic and worn, entire or in pieces, by females who claim to be gentle, tender, sensitive women. Shame on a cruel and barbarous fashion which was, as is well known, established by a Parisian harlot and which no decent women can knowingly imitate! We can but think of that Roman matron who had great sport in seeing two hundred and forty Christian men, women, and children torn piecemeal by lions on a single day.

The extent of the traffic in bird skins is shown by a few facts. In 1880 a New York house received an order from England for 600,000 ox-eye sandpipers. A single ball dress worn in New York City in 1883 was covered with a thousand Brazilian humming birds. A friend of undoubted veracity told the speaker that he saw more than three bushels of birds, — none larger than the robin — brought at one time to a hotel in Florida at which he was a guest.

We are encouraged by the fact that the best men and women are now doing a great work in preventing this destruction. Queen Victoria and the Princess of Wales have emphatically expressed their disapproval of the use of birds in any manner for personal decoration; the latter having ordered that no designs for her own or her daughter's costumes shall include any birds or parts of birds.

Mr. Chase highly praised those earnest, humane persons, Henry Bergh of New York, his associates and successors, and George T. Angell of Massachusetts, who have labored indefatigably to prevent all cruelty to animals, and to preserve to us our native birds. He believed much could be done in our schools by having all the pupils taught to understand not only the economical but the æsthetic value of our birds. It would seem that Mr. Angell and others engaged in like beneficent labors, were specially raised up to devote themselves to works that appeal to, and develop the better side of our nature in behalf of the helpless of either the human race, or the lower animals.

Robert Manning asked whether the cat could not be trained to hunt and kill the harmful kinds of birds, and leave the useful ones. He spoke of a neighbor's cat which was seen to spring into the midst of a group of chickens that were feeding from a dish; but when puss left the spot she had an English sparrow in her jaws instead of the chicken the lookers-on expected to see.

Mr. Hersey said a cat could be cured of the habit of killing chickens or birds by securely fastening a dead one under her chin for a few days.

Mr. Chase spoke of the robins as great favorites of his. Beside their tunefulness they are very useful in destroying cut-worms and many other kinds of injurious insects. It has been estimated that the robins alone, by their consumption of insect pests, save crops in the United States to the value of $20,000,000 annually. They are in the garden and the field early in the morning getting the cut-worms which a little later are hidden in the earth. Then they seek other worms or some variety or form of other insects, almost their entire food being of this character. The thrush is the best of all scavengers, feeding upon the ground, collecting and devouring great swarms of insects with much waste matter beside.

Mr. Chase said he knew the character of the English sparrow, in Europe, before it was brought here to make trouble for us. Several of the countries over there are trying to rid their lands of the nuisance. He said he did all he could to prevent its introduction into the United States. They are most pugnacious and persistent in their attacks upon other birds, a cat, a dog, or even a child. They will gather in large numbers, twitter incessantly, and make feints of attack from all sides, thus harrassing the object of their dislike until, to be rid of the annoyance, the victim will leave

the place to the successful sparrows. Thus they have driven out nearly all of our native birds, which are sorrowfully missed from our gardens, fields, and woods. These sparrows go courting in an interesting way. Sometimes twenty gallants will come after one female, paying their attentions like other bipeds, ruffling up their feathers to show themselves off to the best advantage, chattering, fluttering back and forth about her, promising deathless devotion, flattering, pleading, bowing, scraping, but Miss Unwed seems in no haste. When an undesirable party comes too near, she gives him a sharp peck, and he is off, with a sore head and aching heart. But as soon as she makes her choice, the rejected parties all retire, probably congratulating themselves upon their fortunate escape. Wedding festivities are short, and, sad to say, immediate preparations to raise a family are entered upon. Sometimes several broods are raised in a season. They are seen building their nests as early as the last of February, and half-grown birds have been found as late as the last of November. The speaker had often noticed albinos and part albinos among them. This tendency to albinism is far stronger in America than in Europe, especially in the northern parts. It will probably increase, because white specimens are held in high esteem by the female birds. Government reports show the universal distribution of this saucy, quarrelsome, sturdy little rascal, who, like some of our Knights of Labor, will do no useful work himself, and wishes to expel those who are willing to do any. A fight must be carried on continually all along the line, to keep him in check, as we can have no hope to exterminate him.

On motion of E. W. Wood, a vote of thanks to the essayist for his timely and very interesting paper was unanimously passed.

Francis H. Appleton, of the Committee on Publication and Discussion, announced that on the next Saturday, George E. Davenport, of Medford, would present a paper upon "Ferns."

BUSINESS MEETING.

SATURDAY, March 28, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

No business being brought before the meeting it was

Dissolved.

MEETING FOR DISCUSSION.

FERNS.

By GEORGE E. DAVENPORT, Medford.

The propriety of this morning's discussion in connection with the legitimate work of this Society may perhaps be questioned, as the relationship is not at first apparent. I am confident, however, that it will appear, as we go on, that ferns constitute an important factor in our natural and social economy, and are entitled to be considered as something more than mere botanical specimens for the herbarium.

One of the most gratifying features in the growth and development of our Society during the past few years, has been its increasing disposition to encourage artistic taste and feeling in the different branches of its work. It was for this reason that those somewhat anomalous table and mantel decorations shown during the grand exhibition given by the Society in August, 1890, were justifiable. Such decorative exhibitions call forth the highest artistic faculties of the exhibitor, and awaken corresponding faculties in the minds of the observers. The keener the competition, the broader is the outcome, reaching out to the cultivator, who becomes animated with the desire to improve still further and in every way he can, the material upon which the exhibitor depends for his selections.

If, happily, the exhibitor cultivates his own material, as many do, then is he continually seeking for, and studying choice combinations of color and form in order to produce the most artistic and pleasing effects possible, and in this way he becomes a public benefactor and educator.

You cannot fail to remember the prevalence of ferns in that exhibition, and will readily call to mind the pleasing effects produced by the free use of the graceful and delicate maiden-hair ferns in some of the table decorations, and see at once how closely associated ferns are with the florist's art. So that here at the very outset we trespass upon the florist's province and demonstrate the right of these elegant and beautiful plants, the ferns, to become members of our horticultural fraternity.

The florist finds his colors among the flowering and foliage plants, but is obliged to seek for the highest perfection of form

and grace among the ferns, which in those characteristics are preëminent. Here we have at least one incentive for the study and cultivation of ferns, which must inevitably develop artistic taste and refinement.

I hold it to be quite as much our duty to cultivate the æsthetic side of our nature as it is the practical, and I care not what the strict utilitarian may say; any pursuit which leads us into closer communion with Nature and teaches us to appreciate and love God's works, whether it be a quest for wild flowers, ferns, or any other branch of natural history, deserves encouragement and approbation. The spirit which inspired the great Linnæus when he fell on his knees and thanked God for bestowing so much beauty on a tiny, wild flower, dear to us all, is one that is worthy of our constant emulation.

I recall with feelings of pleasurable emotion the enthusiasm shown by our revered Master in Botany, Dr. Gray, over the tiniest blossoms gathered during an ever to be remembered field day on Bear Hill, in Stoneham — an occasion memorable also from the presence of one whose memory is dear to all lovers of ferns — that pure soul, John Williamson, of Kentucky. The unbounded love and enthusiasm which filled the soul of that great and good man, Asa Gray, kept him always young and overflowing with the exuberant spirits of a boy, and I can never efface from my memory the cheery voice, the buoyant step, and the kindly greeting which always met me when studying ferns at the Cambridge Herbarium.

The study and cultivation of ferns is one of the most delightful of recreations, whether pursued in the spirit of scientific inquiry, or from an æsthetic point of view, and is to be encouraged in both directions; in the first, as contributing to our knowledge of plants and the relations which they bear to other forms of life, and in the second, as increasing the enjoyment and happiness, not only of those who engage in their study, but of others as well, through the refining influence of their beauty.

Ferns are to be distinguished in a general way, from other plants by the following aggregation of characters: their erect leafy habit and generally finely cut foliage; the presence of woody bundles of fibres in their stalks; the production of fruit, either on the under surface of the leafy portion, or in spike-like racemes on separate stalks, and the arrangement of the young fronds in the bud.

They have also in a general way a strong family resemblance one to another, so that one becoming familiar with a few forms may readily distinguish other ferns by their general likeness, even if unable to determine any particular species without close study. There is, however, a great diversity of minor characters by which different species, and even genera, are to be determined, and which require careful study.

Some are evergreen, often with glossy foliage, some are thick and leathery in texture, while others are herbaceous, thin, and almost transparent. Between these extremes there is every gradation. Some are smooth, while others are more or less covered with scales, wool, glands, or powdery substances.

These special characters, for the most part, bear some relation to the situations in which they grow; so that, given the special characters of any particular species, one may not only be able to indicate the localities where it is most likely to be found, but to point out the best mode of treatment for its cultivation.

Thus the larger and coarser ferns, as a rule, grow in moist, shady situations, such as damp woodlands, bogs, swamps, and ravines, while the smaller ferns, and are generally to be looked for along mountain ranges, in dry, exposed situations, and those with a woolly or farinaceous covering, especially in regions where they are subject to long periods of great heat and drought.

Ferns vary no less in size than in their minor characters. The smallest known fern is a southern species which grows in masses, like a moss, on dripping rocks in Alabama, with fronds only from one-half to three-fourths of an inch in height. In striking contrast to this minute fern are the magnificent tree ferns of tropical regions, some of which grow to the extraordinary height of from sixty to eighty feet with immense spreading fronds.

Ferns are widely but unequally distributed in the proportion to flowering plants of about one to eight, to one to two hundred, according to the climatic conditions of the various countries which they inhabit.

As they most abound where shade, warmth, and moisture prevail they reach their highest state of perfection in the humid atmosphere of the tropics. Here their growth is luxuriant and wonderful, attaining the enormous proportions of gigantic trees with huge trunks rising to a great height, and surmounted with correspondingly enormous fronds. As we pass into cooler and

more temperate climates their size and number sensibly decrease, until in colder and extreme northern latitudes they become rare or disappear altogether.

The total number of species in existence cannot be exactly stated, partly on account of the different views held by different authors as to what constitutes a species, but an approximately correct estimate may be given as about three thousand.

In the United States they are in the proportion to flowering plants of about one to forty, this being merely an approximate estimate. The actual number of undisputed species at the present time is 169, all of which are represented in the Society's Herbarium. If to this number we add the 450 or more Mexican ferns not found, as yet, within the limits of the United States, we shall have not far from 620 or more species of ferns belonging to our North American Flora, this being a little more than one-fifth of the whole number in existence.

In former geological periods the relative proportion of ferns was apparently much greater than at the present time, nearly four hundred so-called species of fossil ferns having been described from the coal regions of the United States alone. But some of those determinations are, it seems to me, to be received with a great deal of caution. The best pteridologist will not always venture to name a living plant from the insufficient data of a mere fragment, or from a single frond, if it be imperfect, knowing well from observation on living material constantly passing under his eye, how great is the tendency on the part of living species to vary, even in their most important characters; how much greater then must be the difficulty of determining species from the too often unsatisfactory data of the geological period, when oftentimes one can have nothing more than a simple tracing of a mere fragment in the rock to judge from. Even the one character, which of all others might be considered as the most reliable, *i. e.*, the venation, or nerve-structure, is known to vary greatly in living species; so that if we were to apply the same method to living species as is applied to fossil specimens, we might easily swell the number of our ferns to much greater proportions than we are now willing to give to them.

I propose now to give you a partial review of the life-history of a fern, as distinguished from that of a flowering plant, in order that you may understand more clearly the differences between

them, and then to consider briefly the uses for ferns, to offer some suggestions for making selections for purposes of cultivation, and to point out some of their special characteristics and requirements.

I have here some fronds of *Aspidium Boottii*, a fine, partially evergreen fern, which was first discovered by that excellent botanist and courteous gentleman, William Boott, an honored member of this Society, and named for him by Professor Tuckerman.

If we examine the backs of these fronds we shall find them to be covered with numerous dark dots collected into groups, each group consisting of a number of small, round, or oblong, capsules borne on minute stalks.

These capsules, which are somewhat analogous to seed vessels, though morphologically very different,—are technically called sporangia, and are the spore-cases of ferns, being filled with spores which are the germinating agencies by which ferns are reproduced.

Each group, or cluster of sporangia is called a sorus, and, collectively, the clusters are called sori,—meaning the fruit dots.

If we examine such ferns as our present one before they have fully matured their fruit we shall find the sori protected by a special membraneous covering, or shield, which is technically called an indusium. Ferns having indusia covering the sori are called indusiate ferns, and those without are called non-indusiate ferns.

The presence or absence, and sometimes the form, of the indusium, gives generic distinction to different groups of ferns, and their division and sub-division into sections and species is often based on the character of the indusium alone.

It is now proper to state that the fruitage of a fern plant is to be found collected in the clusters of sporangia, either on the under surface of leafy fronds, like our present one, or in spike-like racemes at the top of distinct stalks partially separated from the leafy portion, as in *Osmunda regalis*, or wholly so, as in the Ostrich fern and our common Sensitive fern. Ferns like these last are said to be dimorphous, *i. e.*, having two distinct kinds of fronds. But in all cases, however much the different kinds of ferns may and do vary in their manner of producing sori, the sporangia are filled when mature with a fine almost impalpable powder, which a microscopical examination shows to be composed

of innumerable grain-like bodies termed spores, the production of which is the ultimate end toward which the whole life-work of a fern is directed.

The enormous quantity of spores which a single fern plant produces annually is something almost beyond computation; but it is so great that if all the spores produced by all the ferns in existence for one year only were to germinate and consummate the purpose for which they are created, they would speedily overrun the earth. But here, as in other directions, are seen the wonderful provisions of nature for equalizing the distribution of life forms. It has been estimated that a single fern will produce in one season one thousand million of spores, and that a single frond of *Aspidium Filix-mas* is capable of producing eighteen millions of plants. Now if we consider the number of fronds which a thrifty plant will support we shall begin to form some idea of the enormous increase which a single plant might be capable of. If we consider further how great a number of individual plants there are in existence, we may well be amazed at the almost inconceivably vast number of ferns which a single year's dissemination of spores is capable of producing. But it is not until we consider still further how infinitesimally small a fractional portion of the whole all this is that we begin to realize, or form an intelligent conception of the magnitude of this grand universe and its marvellous creations.

If we shake gently a mature fern frond, spores will be seen to fall in a showery mass of dust-like powder which very much resembles in general appearance the pollen of flowering plants, such, indeed, as one sees every spring distributed over the surfaces of sluggish pools and streams from willow and alder aments.

But this resemblance goes no farther. Pollen grains in themselves have no germinating power whatever, and remain inert until they perish, unless they come into contact with some stigmatic surface. *Per contra*, every spore has within itself the power of germinating, and under favorable conditions is capable of producing a plant organism. We shall see, however, in a moment, that the plant organism which its germination produces is not a fern, and bears no resemblance whatever to the parent plant from which the spore was produced.

Herein lies the fundamental distinction between a spore and a seed. A seed contains, plainly visible within itself, the rudiments of a new plant, which develops at once, whenever germination

occurs, into a plant similar to that from which the seed was itself produced. But a spore does not contain an embryo, being filled with a thick gelatinous matter instead. On germination taking place this gelatinous matter swells, and expands the elastic inner membrane until it ruptures the outer covering of the spore, and the spore cell protrudes in the form of an elongated sac.

Development then proceeds, through the process of cellular expansion and division, until a flat, leaf-like body is produced, which in its turn, by a new process of growth, develops special fertilizing organs through whose agency the young plant is brought into existence. This form of plant life, so utterly unlike that which is destined to arise from it later on, is technically called a prothallus, or prothallium, meaning thereby an elongated, flat, cellular structure preceding the formation of some plant structure of a higher order. This condition, in some of the lower orders of plants, is in itself the perfected plant structure, as those of you who are acquainted with the Marchantias, and similar plants, know.

I will not weary you with a description of the special organs which are evolved from the substance of the prothallium, nor with the technical points involved in the gradual development of the fern plant itself. Those of you who care to pursue inquiry in that direction further will find the subject carefully elaborated in the series of text-books by Hofmeister, Sachs, De Bary, Bessey, and others. I have dwelt upon it thus far only that you might see how very different from the life-history of a flowering plant, the life-history of a fern is. In the one case we have a plant producing a seed which in its turn reproduces directly the parent plant; while in the other we have a plant which produces an organless cellular body, which produces an entirely different and independent plant form, which in its turn reproduces the original parent plant. So that the cycle of generations runs thus: the fern produces a spore, the spore produces a prothallium, the prothallium produces a fern.

I have here two fine charts, from Dodel-Ports' magnificent work, which illustrate fern reproduction admirably.

In Part 2, plate I, figure 5, we have a portion of a frond of *Aspidium Filix-mas*, one of the shield ferns, a magnified portion of a pinnule showing the sori, or fruit dots. Figure 1 shows a cross section through a sorus wherein the arrangement of the sporangia on the receptacle is plainly seen, with the over-arching indusium. Figure 2 shows a detached sporangium. The elastic

ring surrounding the outer edge is called an annulus. The sudden contraction of this annulus ruptures the ripened sporangium, causing it to split open, when the spores escape, as seen in figure 3; figure 4, spores.

In Part 3, plate IV, figures 1, 2 and 3 show the appearance of a spore shortly after germination. Here we have the protruding spore-sac which continues to grow in the manner previously described, until a prothallium is formed, as seen in figure 4. Figure 5, shows to us the young fern just starting on its life's work.

We have now seen the ultimate results of spore germination, and you have, no doubt, already discovered a partial reason why ferns do not increase more largely by means of spores. For while every spore may produce a prothallium, all prothallia will not produce ferns. A very large proportion prove abortive and perish. Others, being diœcious in character, and becoming separated, or being developed at different times, fail to complete their work. Even monœcious prothallia are subject to so many accidents that only an exceedingly small proportion of them ever succeed in consummating the purpose for which they were designed.

Nature has, however, endowed them with some remarkable properties by which destructive agencies are sometimes counteracted. Smith states that a prothallium may be divided into two or four parts, and each part will produce a plant bud, while Dr. Farlow has shown that prothallia sometimes produce fern plants by a peculiar process of budding without the aid of reproductive organs.

I pass over, as too intricate for demonstration here, the elaboration of reproductive organs on the prothallium, and the subsequent evolution of the young fern, and for its further elucidation refer you to the standard text books previously mentioned. There is also a very careful and elaborate paper by Henfrey, in Vol. XXI of the "Transactions of the Linnean Society," page 117, which may be advantageously consulted.

Hofmeister states that the young plant bears no resemblance at first to a fern and only gradually develops its real character. He also states as a remarkable fact in the life-history of a fern, that whereas the young fern will produce as many as a dozen fronds during the first year of its existence, after it has reached maturity only a single frond will be produced annually, and that a period of four seasons' growth is necessary for the full development of that frond.

From this time on we shall have a great diversity of rootstocks and fronds to characterize the different species and genera of ferns that present themselves to our notice. The structural characters of the most prominent groups of these are represented by the specimens on the screens. I will endeavor to explain them to you briefly by means of some actual specimens which I have selected for this purpose.

While it is theoretically true that all the varying rootstocks of ferns are morphologically related, and are all simply more or less modifications of a true stem, it is also true that these modifications have resulted in certain structural types that fix the habit of the species to which they belong. Two of these types are so marked and distinct, that if we were to base our classification of ferns upon habit alone we might separate them into two large groups, one having upright rootstocks and the other horizontal. But other important considerations enter into our system of classification, so that it often happens that both of these types of rootstock are represented in one and the same genus. The first of these is properly designated by the term caudex, meaning an erect stock or stem, and the second by the term rhizome, or rhizoma, meaning a running or creeping stock or stem with a horizontal growth. There are various modifications of these types which must be passed over for want of time, but most of them may be seen among the specimens on the board, and are designated on the tickets.

The example which I have here is the nearest approach to the true caudex of a tree fern yet known to our United States Flora, and belongs to a variety of *Aspidium conterminum*, growing in Florida and first found by J. Donnell Smith of Baltimore. In this species the caudex rises nearly a foot above the surface of the ground. Professor Robinson has noticed some indications in this direction in our common Rock Shield fern, *Aspidium marginale*, and a very clever and acute lady botanist of the Pacific slope, Mrs. Brandegee, recently called attention to some remarkable developments in the caudex of Osmunda in California.

The best examples of a rhizoma we shall find in *Pteris aquilina*, our common Brake, and *Woodwardia Virginica*, the Chain fern. In both of these ferns the stout rootstock extends under ground for a distance oftentimes of from ten to twelve feet or more.

In summing up the structural characters of ferns we have only time to say that the rootstock is the true stem of the fern, and the

fine or coarse fibres growing downward from the rootstock are the true roots. The leafy branches growing upward from the rootstock are the fronds, a frond being an entire leaf, whether divided or undivided, and with or without a special stalk. When undivided and without a stalk it is said to be entire and sessile; when having a stalk the latter is called the stipes, and the expanding green portion, whether entire or compounded, the lamina; when the lamina is divided the central stalks or ribs, running through the divided portions, are called the rachises; all of these terms being merely special ones for designating the different parts of a frond. The term frond is generally used in a double sense which is often confusing and misleading, but I think that it ought to be used only in one, and that the sense in which I use it here, — that is, to mean the entire leaf, whether with or without a stalk, and not in a sense that would lead one to suppose that it is at any time distinct from its own stalk.

We have seen that reproduction among ferns occurs naturally through the medium of spore dissemination, but there are other ways no less interesting. Many ferns multiply by means of what are called viviparous buds evolved from the epidermal cells of the lamina, or rachis, and such buds develop directly into new plants. The Walking fern is a well-known example of this, the prolonged apices bending over and rooting at their tips, and forming close mats as the young plants creep along.

A Mexican variety of *Asplenium Trichomanes* is remarkably proliferous in this way, as you will see by the illustration of it among the fern photographs on the board, and the late J. Warren Merrill, who was an ardent lover and cultivator of our native ferns, succeeded in multiplying his plants of that rare and curious fern, *Asplenium ebenoides*, by taking advantage of this habit. Indeed, among the Spleenworts the occurrence of these adventitious buds is not only frequent, but some species are especially proliferous in that direction. I have counted as many as twenty or more tiny plantlets sprouting from such buds on a single frond of *Asplenium Glennei*, a small fern not over five inches tall.

Still another mode of propagation is by means of small bulbs produced on the fronds much in the same way as the bulbs are produced on the common tiger lily of our gardens. A notable instance of this is seen in our Bladder fern, *Cystopteris bulbifera*, which produces small bulbs that fall off when matured and, germinating,

produce directly new plants. Sometimes bulbs germinate while on the parent plant, and specimens may often be gathered having young ferns growing out from different parts of the old fronds.

Still another mode of increase is by underground runners, or stolons, extending from the old rootstock, and forming new crowns from which new plants arise. The best example of this that I know of is the Ostrich fern, an old rootstock of which will send out runners to start new plants, which, in time, will send out new runners radiating in all directions until a whole colony of plants springs up and takes possession of an extended area. From a single plant of this species set out in my own grounds some ten years ago, I counted last season over forty crowns all of which are probably connected together by means of these stolons. It will be seen from this how readily such species may be propagated by separating the crowns, and as the Ostrich fern is one of the noblest and most attractive of our native ferns, every lover of beautiful forms having a place for it should cultivate it.

This brings us to the most vital part of our subject to those of you who may be interested in ferns otherwise than botanically. Of what use are ferns, and why should we regard them with any special favor?

We have already seen that they are of use to the florist in furnishing him with graceful forms to add charm to his decorations, and I claim further for our native ferns that they not only equal exotic ferns in loveliness but that they may be cultivated as easily and made to render our homes and gardens more attractive.

We have only to glance over some of the foreign catalogues of plants to see how highly prized our ferns are abroad, and how extensively they are cultivated, and then to wonder why they do not receive more attention here. I am under no necessity for making a plea for them as beautiful objects in nature, capable of inspiring the liveliest emotions of pleasure in the minds of those who seek them out for the enjoyment derived from a contemplation of their many graces and the study of their peculiarities for botanical or scientific purposes, but I press upon you their claims to a more favorable consideration as desirable plants for your gardens and your homes.

Many species of our larger ferns with a little careful attention may be grown into grand and imposing specimens alternating with other plants along garden borders, or in suitable places here and

there on our lawns, by giving to them a rich bed of natural soil, no manure, but plenty of water, and spraying occasionally with hellebore to keep off the insects which are liable to prove the only real difficulty in the way of cultivating fine specimens. I have only time to mention as among the finest of such ferns, beside the Ostrich fern already mentioned, *Aspidium Goldianum* and *A. Filix-mas*, *Asplenium Filix-fœmina*, and the Osmundas. These, and similar ferns with stout caudiciform rootstocks forming large crowns, will thrive better in garden soil than those ferns with running rootstocks like the Chain ferns, the Sensitive fern or the Brake, and others, which require more moisture and consequently thrive best in wet places.

The one guide of all others to follow in cultivating our native ferns is to observe carefully the conditions under which the species reaches its highest development and to endeavor to supply them as far as possible when transplanting.

Among the smaller ferns are many hardy species well adapted for rockeries, which may be so cultivated, readily, by giving to them as nearly as possible conditions similar to those of their native habitats. Even those not hardy may be so grown during the summer months, and afterward taken into the conservatory or house, for the fernery during winter. Among the latter are some of our loveliest ferns, some species having fronds beautifully and delicately cut into numerous bead-like segments, or more or less covered with differently colored scales, or powder, like the Gold and Silver ferns of California.

We are now approaching the best time of all the year for beginning the study of ferns. A few weeks more and they will be pushing up their graceful fronds everywhere in woods and ravines. From their mossy couches on springy hummocks in swampy meadows the noble Osmundas will shortly rise and cast aside the downy coverings which have enveloped and protected them during their period of rest; while along the stony brooksides the Maidenhair and Lady fern will be unfolding their beautiful tresses that have been bound up in tight coils so long. You will have to search carefully among the stones for the young fronds of the Maidenhair as they are scattered along underground rootstocks, but you may know the Lady fern by her bronze or ebony crosiers — a name given to what we might call the nests of young fronds as they lie snugly tucked up in their winter beds, on account of their fancied resemblance to a bishop's crook.

Wherever you find one of these crosiers, you may know that you have found a fern, and by watching the gradual uncoiling and growth of the fronds from day to day you may become acquainted with the general habits and characteristics of ferns, and so gain a practical knowledge of them.

But I have trespassed upon your time too long, and I must bring this paper to a close. The subject is one that presents itself in so many different ways that it is well-nigh inexhaustible, and might be prolonged through a series of such papers. I am by no means sure that I have presented my paper on this subject in the best possible manner but I have been anxious to avoid anything like a strictly scientific technical treatment, and to make my paper merely as suggestive as possible. Beyond this I must refer you for general investigation and study to Professor Eaton's splendid work on our North American Ferns; to Professor Underwood's admirable hand-book of "Our Native Ferns"; to Professor Robinson's invaluable book on "Ferns in Their Homes and Ours," and to John Williamson's precious legacy to fern lovers, the "Ferns of Kentucky" and "Fern Etchings." These works cover general grounds quite thoroughly, but if a more scientific study is desired you will be obliged to resort to the text-books previously mentioned.

Of one thing I can assure you. In whichever direction you may choose to follow out this study you will find it a delightful one. There is an indescribable charm and fascination surrounding ferns that no other plants possess. They represent the highest types of graceful forms, and so long as the human mind retains its susceptibility to the influence of the beautiful in nature so long will ferns continue to attract and interest mankind.

I need say no more, but let the ferns shown here this morning speak the rest for themselves, and I am sure that you will agree with me when I say that they are more eloquent than any words of mine. For however much one may feel the inspiration which emanates from them there is yet something wanting in the power of speech to give it utterance. We may, indeed, describe in impassioned words their outward charms, but the essence of all, like the aroma of the pine woods and the odor of spring flowers, escapes into that rarer atmosphere which bathes the soul in unspeakable delight. There are times when the overpowering mastery of our feelings prevents all outward manifestation, and

we can only bend in silent reverence for that Supreme Being who has surrounded us with so many things to make life worth the living, and endowed us with capabilities for their appreciation and enjoyment.

DISCUSSION.

Thomas Harrison inquired about methods of multiplying fern plants.

Mr. Davenport replied that he had never attempted propagation of ferns; he had not even tried spores. He recommended division of the roots and separation of crowns.

Mr. Harrison asked whether in propagating ferns they always produce the same variety, or sometimes sport.

Mr. Davenport doubted the possibility of cross-fertilization; as to sports, it is a common trait of many ferns to vary in the course of development.

Mrs. P. D. Richards said she had young fern plants coming up in the pots. While she saw no opportunity for the cross-fertilization of ferns, she was aware that spores were readily taken up by air-currents and carried to distant points where their germination and growth were effected, perhaps to the surprise of the person who thus obtained these beautiful ferns. She had found unexpected treasures growing among her collection of choice ferns, which proved identical in kind with specimens in her herbarium. She said an idea prevails widely that ferns cannot be grown in our dwellings, and she wished to state that it was erroneous. She had an Ostrich fern at a west window, where it grew in vase form very successfully; she had hoped to keep it growing longer by having it in the house, but she gained only two or three weeks of extra time. She recommended *Asplenium ebeneum* for house culture.

Mrs. C. N. S. Horner was glad to emphasize the lecturer's suggestion that ferns should be more generally cultivated by the people. She knew they were more easily cultivated than the flowering plants.

Another lady stated that she had successfully cultivated the Maiden-hair fern and also the Ostrich fern. Her own experience prompted her to say with the essayist, that if any present wished for pure enjoyment at home they should cultivate ferns.

Mrs. Horner desired to say she had cultivated ferns for many years, and had enjoyed them in-doors in winter but had usually

put them in the ground for summer. Most of them grow best in shady places, but Adiantum grows equally well in sun or shade. If she had not given away a large number she would now have a square rod of this beautiful fern. She thought the Ostrich fern another desirable species, if one has plenty of room.

E. H. Hitchings wondered that no more interest was taken in the cultivation of ferns, especially our native species and varieties. Many of them are perfectly hardy and will bear more hard treatment than any other plants that he knew. Some time in the winter of 1883, he received from Charles G. Pringle, of Vermont, a package of ferns, natives of the Pacific Slope, and among them were *Pellæa Breweri*, collected September 27, 1882. He was busy at the time and laid them aside in a drawer, to be mounted and placed in his herbarium when convenient. The convenient time did not arrive until about two years after the ferns were collected. Then, after placing some of the fronds in his herbarium, he put one of the roots in water for a week or two, and then planted it in a pot, where it grew, and he now has several fronds from it in his herbarium. Perhaps this may not seem remarkable, because those ferns have to endure the long, dry season of the Pacific slope; he therefore gave another case, nearer home. On September 2, 1888, he went with a friend to Lexington and took up a number of plants of the Ostrich fern, intending to set them out in the woods near home. They were left in a basket in the cellar until May 28, 1890, — nearly twenty months — when he found them still alive and growing. He then set them out and they grew well during the season. Besides the Ostrich fern, he had planted the *Osmunda regalis* and *O. cinnamomea*, *Aspidium Thelypteris*, *A. Noveboracense*, *A. spinulosum*, *Woodwardia angustifolia* and others. They need but very little care if planted in a suitable place, which should be in the shade, in rather rich soil, not wet, except for a few species. He thought some of our native ferns were improved when grown under glass. He said the late J. W. Merrill, of Cambridge, was very successful in cultivating many of our rarer species. Some of them are also grown at the Botanic Garden, Cambridge. David Allan, gardener to Robert M. Pratt, Oakley Park, Watertown, has grown some very fine specimens — handsomer than any the speaker had ever seen growing in their own homes. John Robinson, of Salem, recently Professor of Botany and Vegetable Physiology to this Society, has successfully

cultivated rare native and foreign varieties, both under glass and in the open air. In this connection Mr. Hitchings recommended, for any one interested in the subject, Mr. Robinson's book—"Ferns in Their Homes and Ours." The book is very interesting, even if one does not intend to cultivate the ferns. Another book he would recommend is an English work, "The Fern Garden," by Shirley Hibberd.

A few of our rarer ferns that have been successfully cultivated are:

Acrostichum aureum,
Adiantum tenerum,
Anemia Mexicana,
Aspidium trifoliatum,
Asplenium cicutarium,
" *ebenoides*,
" *myriophyllum*,
Ceratopteris thalictroides,
Cheilanthes tomentosa,
Notholœna sinuata,
Pellœa flexuosa,
Polypodium aureum,
" *Phyllitidis*,
" *plumula*,
Woodwardia radicans.

Some of them vary a great deal *in cultivation;* the *Scolopendrium* and *Asplenium Filix-fœmina* he thought more than most others, the former having one hundred named varieties. Some of our own ferns vary a great deal in their native habitats, others scarcely any. He has specimens of *Phegopteris Dryopteris* from England, Ireland, Switzerland, Maine, New Hampshire, and the Middlesex Fells, and he had never seen the slightest variation among them except in size. But *Phegopteris polypodioides* and *P. hexagonoptera* vary a great deal in form; so much so that it is sometimes hard to decide whether a specimen should be called *polypodioides* or *hexagonoptera;* in fact some persons think they are simply variations of the same species.

A few years ago Mr. Hitchings met Professor Eaton at the Harvard Herbarium rooms, and asked him where he drew the line between these two ferns. He replied: "If you find a frond that measures one-sixteenth of an inch wider than it is long, call it *hexagonoptera*, if one-sixteenth narrower call it *polypodioides*." [The speaker exhibited specimen fronds of each variety, which clearly showed the points he had stated in regard to these varieties.] But the fern that varies most is, he thought, *Botrychium ternatum*. You may collect a hundred specimens and no two of them will be alike; but you may be sure they are all varieties of *Botrychium ternatum*.

[To illustrate this statement Mr. Hitchings showed twenty-four sheets, from his herbarium, containing one hundred and forty specimens of *Botrychium ternatum* varieties, a curious and interesting exhibition.]

But to get the most satisfaction from ferns one should collect them. Shirley Hibberd, in his "Fern Garden," says, "I believe no one can thoroughly enjoy or understand ferns until after having actually hunted for them in hedgerows, woods, and amongst rocks, and rivulets, and waterfalls. The . . fern may be allowed to sing . . . :

> Through the woods, through the woods,
> Follow and find me,
> Search every hollow, and dingle, and dell,
> I leave but the print of my footsteps behind me;
> So those who would find me must search for me well."

If this were written of the little Adder's tongue fern, or some of the smaller Botrychiums, there would be a great deal of truth in it. Mr. Hitchings then quoted from Robinson's "Ferns in Their Homes and Ours," as follows:

"There is a large class of persons who . . . have to do only what they choose. This class must have a 'hobby,' or they will *rust* out. Another class are engrossed by incessant professional work which leaves them every day cross and tired. These should have some outside hobby, or they will become one-sided and crabbed, and *wear* out." For illustration he says: "Dr. Jacob Bigelow, of Boston, being a hard and earnest worker in his profession, determined, for his own good, to select some sensible form of recreation; and chose the study of botany, as necessitating long walks and refreshing thoughts. The result was the publication, in 1814, of his 'Florula Bostoniensis.'" "All this came from a hobby," says Robinson, who further writes: "Every person, old or young, outside of an asylum for the insane, should have some one thing in which an intellectual interest is taken,—some hobby, or something that may grow into one." And while he would not "claim that the fern-mania . . . is a hobby superior to most others, . . . he does claim, that, properly guided, it can be the means of stimulating pure and healthy exercise and study; and . . . may be the cause of great and permanent good."

Mrs. Piper remarked that if one would transfer a Maiden-hair fern from its native spot to the fern garden, it should be done

before the fruit had appeared, otherwise it would be too far exhausted to establish itself there.

Miss Nichols inquired if the fern garden could be protected from devouring insects.

Mr. Fernald spoke of a small insect, of a new kind, which has of late infested ferns. It draws the leaves together in a loose bunch, and then feeds upon them. The only treatment he advised was to open the bunches and kill the insect.

Interest was added to Mr. Davenport's paper by herbarium specimens, some of which were mounted on screens, as well as by the plates from Dodel-Ports' "Anatomical and Physiological Atlas of Botany." The latter and the other books referred to can be seen in the Society's Library. On motion, a vote of thanks to the essayist for his interesting and instructive paper was unanimously passed.

O. B. Hadwen, Chairman of the Committee on Publication and Discussion stated that the regular course of Meetings for Discussion closed with Mr. Davenport's lecture, but he was happy to announce that another was promised for Saturday, April 11, by Col. Henry W. Wilson, of Boston, upon his recent "Visit to the Bahama Islands, and the Character of their Horticulture and Agriculture."

BUSINESS MEETING.

SATURDAY, April 4, 1891.

A duly notified stated meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

The following named persons were proposed for membership:

Everett W. Raddin, of Cambridgeport, proposed by James T. Carroll.

Dudley F. Hunt, of Reading, proposed by George Heywood, as a Life member.

George Murch, of Milton, proposed by Edwin A. Hall, as an Annual member.

Maurice P. White, of Roxbury, proposed by Leverett M. Chase.

John Davis, of Lowell, proposed by Edwin Sheppard, as a Life member.

The President, as Chairman of the Committee on the Revision of the Constitution and By-Laws, presented a majority and a minority report of that Committee. The report having been, agreeably to a vote of the Committee, printed and sent to every member of the Society, it was voted that the reading be by title and that the Secretary state the changes from the Constitution and By-Laws now in force.

Joseph H. Woodford moved that the report be accepted and the Committee discharged.

Benjamin P. Ware moved the adoption of the majority report.

I. Gilbert Robbins moved to adopt the whole report, both majority and minority. After some discussion by Francis H. Appleton, Mr. Robbins, Benjamin P. Ware, William C. Strong, and J. D. W. French, this motion was withdrawn.

Mr. Robbins then moved that the amendments offered by the minority of the Committee be adopted in place of the report of the majority.

Mr. Woodford moved to amend the motion of Mr. Robbins so that the Superintendent of the Building, and the Librarian should be chosen at the annual election. This amendment was accepted by Mr. Robbins. The vote was then taken on his motion, as amended, and it was negatived.

Henry P. Walcott moved to amend Section VI, by substituting "second" for "first" in the last line of the second paragraph; but accepted an amendment substituting "third" instead of "second." Dr. Walcott's motion, as thus amended, was then carried.

The question was then put on Mr. Ware's motion, viz., that the majority report, as thus amended, be adopted, which was carried, and the revised code was ordered, by a majority vote, to be entered on the records, for final consideration on the first Saturday in July.

The following named persons having been recommended by the Executive Committee for membership in the Society, were on ballot duly elected.

ALFRED P. GAGE, of Arlington,
MRS. LEWIS J. BIRD, of Roxbury,
CHARLES S. YOUNG, of Newton Centre,
SAMUEL HENSHAW, of Thompson, Conn.

Adjourned to Saturday, April 11.

BUSINESS MEETING.

SATURDAY, April 11, 1891.

An adjourned meeting of the Society was holden at eleven o'clock, the President, WILLIAM H. SPOONER, in the chair.

Francis Campbell, of Cambridge, was proposed by David Allan, as a Life member of the Society.

John M. Keyes, of Concord, was proposed by John H. Moore, as a member of the Society.

Adjourned to Saturday, May 2.

MEETING FOR DISCUSSION.

A WINTER VISIT TO THE BAHAMA ISLANDS.

By Col. HENRY W. WILSON, Boston.

This interesting group of islands is often confounded with the Bermudas, even by persons otherwise well informed. The latter are in Lat. 32° N., Long. 66° W., while the Bahamas extend from Lat. 22° to 27° 20′ N. and from Long. 72° 30′ to 79° 20′ W. Nassau, the principal commercial point, being in Lat. 25° 05′ N. and Long. 77° 21′ W., is about 800 miles southwest of Bermuda, 1050 miles, almost due south, from New York and about 350 miles, a little north of east, from Key West.

It is to some of the experiences and observations of a winter's visit to these islands, last February, that the attention of the Society will be called for a brief hour.

Not often can a midwinter voyage be made with bright skies and unruffled seas, with no more motion than one would meet on an excursion boat on a June day in Boston Bay. You soon fall into a regular routine of life which lasts just long enough to avoid tedium. You cannot fail to be an early riser in order to view the sun emerging as from a bath in the wilderness of waters; breakfast, and then pace the deck, fore and aft for an hour, as exercise; consult the patent log hourly, if not oftener, to assure yourself that you are going along all right; speculate as to the distance run for

twenty-four hours; superintend the captain and first officer as they take the sun and wonder why it takes thirty minutes to figure out a five minute problem; lunch; admire the great persistence of a flock of sea-gulls that for forty-eight hours and for five hundred miles hover over the track of the steamer ready to pounce upon whatever the cooks may throw overboard; wonder whether they can have any abiding place but the deep sea, or whether it may not be a handy thing after all to be able to make yourself comfortably at home wherever you may happen to be; count the strokes of the engine and estimate the revolutions of the screw to make the passage; dine; discuss the McKinley Bill and lose your patience, if not your temper, as you try to make your companion understand how a tariff is a skilful device for making foreign nations pay your own taxes for support of the Government; find quiet for your perturbed spirit in looking upon the glories of the sunset as the fiery ball drops gently below the horizon; as the twilight deepens into night and darkness draws her sable curtain over the deep and pins it with a star, you linger at the taffrail to watch the fascinating phosphorescence of the wake which the steamer is leaving miles astern. This experience is repeated day after day, varied only by an occasional sail, a flight of flying-fish, pursued by a lazily rolling dolphin, or a jaunty nautilus sailing by in its buoyant bark. At last the steamer is brought to anchor in forty-five fathoms of water, off a low-lying shore, where a stuffy little steamer comes alongside to take the freight and passengers ashore, and you realize that Nassau has a prohibitory bar which effectually closes her harbor to all steamers or vessels that draw more than fifteen feet of water. This bar is not of shifting sand, as frequently occurs, but good hard coral limestone which would effectually settle the fate of any vessel going upon it.

Approaching the wharf one is easily persuaded that about all of the floating population of the town has gathered there to greet him, but, on considering that there are but three or four hundred out of twelve thousand or more, he modifies his conclusions, as he does concerning the importunate beggars that beset him on every hand and clamor for alms. In his vexation the traveller will say these people are all beggars, but when he reflects that there are but a score or two of the persistent pests, and these only about the wharves on steamer days, he concludes that mendicancy is not so common and gives credit for there not being more of it.

The first public functionary one meets is the custom-house officer, who is obliging and discreet, and who receives and passes you with so much courtesy and dispatch that a pleasant impression is left on your mind which goes to relieve your vexation at the volunteer porters who have persisted, unbidden, in pawing over your luggage and making their needless exertions the basis of a claim for a shilling. If every traveller could bear a frown, or say no, this fruitful source of irritation would soon cease. Arriving at the hotel, which like everything else in a British colony is a Royal Victoria, and which is roomy, comfortable and excellently managed by a Connecticut hotel-keeper, you speedily make yourself at home and begin to look about you.

One observes, particularly about Nassau, the quaint and colonial aspect of the enclosures and buildings; the peculiar walls, breast-high, formed of pieces of coral limestone laid dry and then well plastered over with lime-mortar, giving to each enclosure all of the effect of exclusive proprietorship that would be given by a tight board fence. Most of the buildings, both public and private, are built of regular blocks of limestone which is easily quarried and dressed into any desired form with a hatchet and saw.

The streets of Nassau are regular, clean, and well laid out. The abundance of trees which line the streets tend greatly to relieve the bright glare of reflected sunlight, which rather oppresses the Northerner when experienced for the first time.

One of the agreeable features of a winter experience in these islands comes from the uniformly equable temperature of air and water. During the entire month of February, 1891, the thermometer fell below 70° on only one occasion, toward the end of the month, when for a part of the day it fell to 65°. The temperature at sunrise averaged from 70° to 72°; at noon from 78° to 82°; at sunset from 74° to 76°. The temperature of the ocean was, in the morning, 70° to 72° and at evening from 74° to 76°. It was claimed by old citizens that the lowest temperature ever known was 64°. The bitterly cold wave which passed over the whole of the United States and covered Florida with frost, had only refrigeration enough left, when, in the last week of February, it crossed the Gulf Stream and reached Nassau, to reduce the temperature for a short time to 65°. Such an equable climate is not only beneficial to invalids but is a source of enjoyment to those in health. It enables a careful gardener to supply the table with a

constant succession of delicious vegetables the year round. Instead of there being a dry and a rainy season, as is the case in most tropical and semi-tropical countries, the showers here fall at intervals and the rainfall of the year is quite as uniformly distributed during the several months and seasons as at the north, and averages about two and a half inches per month, which is fully adequate for perfect success in agriculture.

The extreme transparency and brilliancy of the atmosphere and sky is in great contrast to what we are accustomed to see at home. The clouds soar high and are broken into fine masses with magnificent contrasts of color. Even the waters combine to challenge our admiration by the gorgeous hues which they present to the delighted beholder. Looking from a height upon the broad surface of the bay I have seen its waters striped with creamy white and brilliant pink, with broad areas of intensest blue, flecked with bright spots, till it has almost seemed to me that the eye that designed our starry flag had at some time tarried among these kaleidoscopic views and drawn its inspiration from their glowing scenes.

The harbor of Nassau is formed by a long, low, narrow island, called euphoniously Hog Island, which lies to the north and nearly parallel with the island of New Providence, the channel between being from one-third to one-half of a mile wide, the westerly end of which, having a depth of from fifteen to seventeen feet, constitutes the proper harbor of Nassau. The bar before mentioned, which projects to the westward, in a continuation of Hog Island, and upon which the surf breaks constantly, will ever be a serious impediment to modern commerce, although small vessels enter without difficulty.

The Bahamas comprise eighteen principal islands having a total area of about 3,310,000 acres or pretty nearly three-fourths the area of the State of Massachusetts. There are several hundred small islands, or cays, of limited area, many of which are little better than bare rocks. Of these islands the largest is Andros Island, with a length of 90 miles, and an area of nearly 2,475 square miles. Abaco, Eleuthera, Great Bahama, Inagua and San Salvador, have each an area of more than 100,000 acres. The population of the whole group of islands was 43,521 in 1881. New Providence has an area of perhaps 85 square miles and according to the enumeration of 1881, a population of 11,650, most

of which is concentrated in and about Nassau. The present population is estimated at 14,000 of whom about one-sixth are white, the remainder being negroes, mostly born on the islands, and, of course, descended from the victims of the African slave trade. Close observation will enable one occasionally to distinguish in the negro quarters of the town, faces that bear in the tribal marks and scars unmistakable evidence of African nativity. These have been rescued from slave ships and liberated on these islands.

The original inhabitants at the time of the discovery by Columbus were a peaceable and inoffensive race; they were all carried into slavery by the remorseless Spaniards and their lives were sacrificed in the mines of San Domingo or the pearl fisheries of Cumana. They were of a proud and independent spirit, not yielding readily to slavery, and by the time a generation had passed away not a descendant of the Lucayan Indians remained, and for more than one hundred years these islands remained desolate and uninhabited. The negroes have a tradition that there is a remnant of these aboriginal natives yet living in the depths of the forests on Andros Island, and no negro can by any means be persuaded to venture from the coast into the forests which cover the island, for fear of the wild men, whom they call "Yahoo;" but no good foundation could be ascertained for this belief.

The white population, as stated, comprises perhaps no more than one-sixth of the whole. Many of them are descended from the same stock as our best New England population, to which there is quite a strong resemblance both in speech and manner; nor have we far to go for the explanation. A large part of the emigration to the Carolinas, in the early part of the eighteenth century, was of Scotch extraction from the north of Ireland and the same that furnished much of the hardy yeomanry of New England.

Singularly enough, while in the North these people were the staunchest patriots, in the South they were among the most ardent Loyalists and at the close of the American Revolution they emigrated in large numbers to the Bahamas. Great Britain had purchased the rights of the Lords Proprietors and made large grants of lands to these Loyalists on which were soon established many prosperous plantations. The energy and industry of these people are plainly evinced today in the clearings, enclosures and

Cocoa Nut Tree.

Showing fruit at various stages ot growth.

buildings which were made under adverse circumstances. The mace which was used as the symbol of Royal authority in the assembly of South Carolina, was carried to Nassau and now does service as such in the Colonial House of Assembly.

The structure of their social and industrial systems was based upon slavery and, upon its abolition in 1837, every department of industry and trade was rudely arrested and has since languished, excepting during the brief years of the American Civil War, when the facilities which the islands afforded for blockade-running gave such an unnatural stimulus to trade and speculation that everybody plunged in, to be hopelessly stranded when the bubble of disunion was broken.

Andros Island, which is larger than all of the others put together, was named for Sir Edmund Andros who was Governor of Massachusetts from December 20, 1686, until April 18, 1689. When the news of the abdication and flight of James the Second reached the colonies, Governor Andros was seized by the men of Boston, deposed, imprisoned and sent to England. No judicial decision was ever made in his case, as the authorities were on the horns of a dilemma whether they condemned him or acquitted him of tyrannical proceedings in the Colonies, but he was subsequently appointed Governor of Virginia, where his conduct was marked by more moderation and was generally acceptable. He was subsequently one of the Lords Proprietors of the Bahamas and died in England in 1714.

William Shirley was Governor of Massachusetts from 1741 to 1756, and was, possibly, until his ill-starred military operations of 1755, one of the most popular Royal Governors Massachusetts ever had. Point Shirley is a reminder of the esteem in which he was held in Boston, and of the grand celebration on the 8th of September, 1753, when all Boston seemed intoxicated with the prospect of the establishment of glass-making at the Point,—a prospect which never materialized. In 1759, Governor Shirley was appointed Governor of the Bahamas and so continued till 1767. The rambler around Nassau cannot fail to pass through Shirley street, one of the principal thoroughfares, also named after the Governor. From these considerations, as well as others that might be added if time permitted, Nassau is peculiarly interesting to a New Englander but especially to a Bostonian.

To one who has never visited the Tropics, the strange conditions and species of vegetable life seem most remarkable; familiar

as he may be, by means of narratives or prints, with such things, still the beholding moves one with a new emotion. There is a curious interest in witnessing the peculiar growth of the Cocoa Palm (*Cocos nucifera*), with its constant presence of blossoms and fruit. We were permitted to see this fine tree in all stages of its growth, first as a germinating nut with its fronds of green leaves bursting through its husky envelope; then as a young tree not so tall but that I might pluck the fruit from the ground, and maturer trees, from forty to forty-five feet in height, that would require the dexterity of an agile boy or monkey to climb to seek the fruit. The trunk of the cocoa palm is from six to ten inches through; it is endogenous, growing at the end of the stem and, therefore, has all of its foliage at the extremity of the trunk. Every month a new leaf or spathe expands itself from the fibrous integument in which it is enfolded and discloses a spadix of bloom and so it happens that there is always to be seen, on a healthy and growing specimen of this species, the blossom, below this the small nuts, the size of walnuts; beneath them a cluster of from six to ten larger ones the size of the fist; and below these the ripening nuts, each hanging by a slender stem, not so large as a lead pencil. It is claimed, I cannot say how truly, that from a thrifty tree one may pick a ripened cocoa-nut every day in the year. The planting of this picturesque tree is so simple a matter as the excavation of a shallow hole in the sand and placing therein a sprouted nut, covering it and leaving it to care for itself. If at a distance from the salt water, it is the custom to place a quart of coarse salt in the hole with the nut, as the tree is said to be partial to the salt water and grows with the greatest freedom near to the seashore. It fruits at the age of four years.

Another remarkable and striking tree is the silk-cotton tree, *Bombax Ceiba*, which, when a young tree, has a clear, round trunk of a gray color but thickly covered with stout spines or thorns projecting from one-fourth to three-fourths of an inch. At this stage of its growth it is called the monkey teaser as it must greatly perplex the monkey tribe to climb its prickly trunk in a hurry and not get badly scratched. As the tree increases in size it throws out huge buttresses around the base of its stem, as if to brace itself for the terrible tempests which sooner or later it must encounter. The largest tree of this species is in the rear of the Public Building on Bay Street at the corner of Parliament Street.

Bombax Ceiba Tree.

ROYAL AFRICAN PALM.

It is fifty or sixty feet in height and is a medium-sized tree. The spread of its limbs is about one hundred and twenty feet in one direction by about ninety in the other and its buttresses project in a helical manner fully fifteen feet from the base of the main trunk. It is a native of South America, deciduous, and bears an exuberance of long pods filled with a silky fibre, whence comes its name, and it is a favorite custom with visitors to have themselves photographed among its spreading buttresses, as a souvenir of their visit. The native colored people of the West Indies are very superstitious concerning this tree and think not only that the goblins sport in its branches by night, but that any indignity shown to it, such as the casting of stones at it, will be certainly resented by some calamity, as sickness or death, being visited upon the family or friends of the offender.

Some stately specimens of the African Palm, called in Nassau the Royal Palm, are to be seen with their smooth, swelling trunks, having a gray, stony appearance as if turned in a lathe out of stone, and of a great height. The upper portion of the trunk is smaller in diameter, smooth, and green, generally with an abortive attempt at the production of fruit hanging withered just below the feathery foliage which crowns the summit of the tree.

The Leguminosæ — the great family of pod-bearing trees, of which the acacia is the type — are common and striking objects in the streets, parks and private grounds. The pods are of all kinds and colors from bright, golden yellow to jet black; some are small and light, others large and heavy enough to serve as formidable weapons and require much force to tear them open. Of this kind is the Poinciana tree. The Tamarind (*Tamarindus occidentalis*) is also of this family; it is not so fine in fruit as the *T. Indica*, which has a large pod with a fine pulp, but nevertheless a tolerable preserve is made by packing in layers of sugar the pulp extracted from the pods. It has a pleasant acid flavor and makes a grateful, cooling and nutritious drink in sickness.

Orange trees are quite abundant and the fruit is excellent and cheap, the highest price being one dollar per hundred at Nassau, while at other places on the out-islands it was to be obtained for fifty cents per hundred and in some instances was to be had for the asking,— nice, luscious fruit. Limes were common, fine and cheap. They were obtained for twenty-five cents per half-peck.

The Sapodilla is a striking and interesting tree to the New Englander, being when full grown, large and of fine shape, something like a well-pruned pear tree, and when loaded with its large, russet-colored, ovate-shaped fruit, is very ornamental. The fruit has a soft, pulpy flesh with a sweetish taste, described by those who are fond of it as being like sugared honey.

Of the so-called Cabbage Palms there are several fine types to be seen. This tree receives its name from the use that is made of the young and succulent leaves which form a head and sometimes also of the terminal bud, which are cooked and eaten as a salad. Whether these trees were the *Areca oleracea*, a true palm, or the *Sabal Palmetto* which is a similar tree and used for a similar purpose, I was not botanist enough to determine nor did I find anyone who was. However, as the palmetto is a common tree and the *Sabal serrulata* or Saw Palmetto is universally found in the thickets or scrub, as it is called, very probably the so-called palm is merely a palmetto.

Time will not permit the enumeration of all of these interesting forms of vegetable life, but I will allude, in passing, to the India rubber tree, the *Siphonia Cahuchu* of South America, of which there are fine specimens to be seen. It is, of course, an exotic, but thrives and might doubtless be easily propagated. Its kindred tree, the *Ficus elastica*, which is a source of the elastic gum in the east, is a sort of connecting link between the Cahuchu and the wild fig which is indigenous to the Bahamas, and has the habit peculiar to the oriental Banyan tree, *Ficus Indica*, of throwing down shoots from its branches, which upon reaching the earth take root and form additional supports for its spreading top. A fine specimen of this tree stands near the highway, a short distance to the eastward from the centre of the town, and is commonly called the Banyan tree, although there has always been a controversy as to its identity with the true East Indian Banyan.

In order to understand or appreciate the agriculture of these islands one must know something of the peculiar formation, texture, and condition of the soil. The underlying rock throughout the Bahama Islands is a coralline limestone. This is formed of the comminuted fragments of coral and shells, torn to pieces and worn by the ceaseless agitation of the ocean, thrown up into ridges twelve and fifteen feet in height and intermingled with enormous masses of algæ torn from the ocean's bed by the tempest; blown

POINCIANA REGIA (Flamboyant Tree).

BANYAN TREE.

by the trade-winds into sand dunes thirty and forty feet in height, to be crested and covered with a profusion of trailing leguminous plants, notably the *Batatas littoralis*, with various grasses and shrubs, among which the scrubby Palmetto (*Sabal serrulata*) is common. These all serve to retain the sands in place, prevent their shifting, and arrest new deposits through which they continue to grow with surprising luxuriance. These great sand dunes in time become indurated by the continued action of the rains from the well-known effect of the carbonic acid, prevalent in rain water, which cements the grains of oölitic sand into a dense and even crystalline limestone rock.

These masses of algæ, as well as the foliage and stems of the shrubs, decompose in the places where the sands have buried them, the result being that the solid and compact oölitic rock is penetrated through and through with apertures, channels, crannies and cavities that are filled with decomposed vegetable matter, so that while to the uninformed eye the surface of the ground may seem as bare and hopeless of sustaining vegetable life as are the tops of our Quincy ledges, the fact is that one has but to break a hole into the surface of the rock, put in a little soil which may be scraped together, insert the seeds or plants and leave them to their own devices, with the certainty that they will germinate and thrive, pushing their roots out and around into these various interstices that have been filled, by the processes of nature, with just the kind of material best suited for their sustenance and growth. In most fields that have not been artificially prepared, the natural surface covering of soil is but slight, and in some that I saw the surface seemed to be nothing but honey-combed rock, entirely destitute of soil, and yet it was covered with a vigorous growth of shrubs and trees. Upon such ground there is no chance to use either spade or plough, neither do you see them in use anywhere, the principal and most effective implements of husbandry being the crowbar, pickaxe and sledge-hammer.

To make a fruitful vegetable garden all that is required is to pulverize the surface of the limestone rock, which becomes mingled with what vegetable matter there is, while more is speedily added from the rank growth of vegetation which invariably follows, and a good friable soil of sufficient depth is the result. Thus it is apparent that land which would well sustain a thrifty growth of trees and shrubs would not, by any means, answer for a vegetable

garden; but by the expenditure of time and strength one may be prepared in the manner indicated, at the rate of about two square rods for a day's work, and at fifty cents per day, which is the prevailing rate for wages, the cost of the thorough preparation of the soil for the highest culture would be about $40 per acre.

Owing to the facility with which this limestone rock is quarried, it is cut out in square blocks and the floor of the quarry is easily left with a fair surface and but little unevenness. This, of course, is covered with the pulverized rock and débris — the result of working the stone — which soon forms a mellow soil that is readily put into the finest condition for the orchard or the garden, so that in some of these worked-out quarries can be found a luxuriant growth of fruits and vegetables. In such situations the growth of vegetable life may be made perennial. One can supply the table every day in the year with every desirable vegetable, but it would be essential to constantly renew the supply of seeds from the north, owing to the natural tendency to deterioration, the inferiority of the vegetables seen in the market, compared with those of the same sorts to which we are accustomed at home, being quite noticeable.

This market was a study and a revelation. It is well situated on the main street and extends to the harbor. The stalls are put up at public auction at intervals of three months, and the renter may sell everything except hardware, crockery, dry goods and liquors.

Outside of the market, around the passageways and on the wharf, persons, mostly women, are allowed the privilege of selling poultry, crabs and vegetables upon the payment of sixpence per day — about twelve cents. These people will walk in a mile and a half or two miles from Grant's Town, which is peculiarly the negro community, at a very early hour of the morning bringing their little stock of vegetables in a basket borne upon the head. On arriving at their allotted space at the market, they spread their goods upon a box, a board, or the head of a barrel. A few potatoes or yams, onions, tomatoes, martynias — a few beans, beets, turnips, radishes, or some little sticks of sugar-cane — are grouped together in small lots to the value of a ha'-penny, a penny or a check, which is a penny and a half. One parcel that was noticed particularly, consisted simply of one small tomato and half an onion and was valued at a ha'-penny. The purchaser, generally a negro, lays down the coin, sweeps the allotted portion into the basket without uttering a word, and passes on.

ST. AGNES' CHURCH, GRANTSTOWN.

Outside the market, on the sidewalk, will be a line of men and boys sitting upon the curbstone, each with a bundle or two of fodder or a few faggots of firewood deposited in the gutter. Horses are not common on any of the islands, the customary beast of burden being a diminutive mule or donkey. It did not seem as though the sales of these people could average more than two or three shillings per day, which would indicate the putting forth of considerable effort for rather meagre returns.

Here it may be fitting to give the results of some observations on the labor problem as viewed in Nassau. The price of wages for an able-bodied man is fifty cents per day, women receiving less, — barely half. It is not correct to represent these people as being averse to labor, as is sometimes done without reflection. They seemed to be as willing to work as anybody else. It has been only in rare instances that any people have been observed to labor for the enjoyment it gave them. A gentleman, largely concerned in the canning of pineapples, gave the assurance that when his hands once thoroughly understood what he desired of them and the way it was to be performed, he had no difficulty whatever in obtaining regular and willing service which was fairly satisfactory. They seemed ready and anxious to please and would linger around the premises when their stint was performed. As the work in this case proceeded by stages some had to begin earlier than others, who of course wrought later to finish up, but all seemed eager to work and contented when busy. The day's stint for a woman was the paring of one thousand pineapples for which she received thirty cents. Any person who voluntarily assumes such a contract cannot be said to be averse to labor.

It was a part of the programme of excursion to spend two or three weeks cruising among the islands and visiting some of the outlying settlements. A complete camping outfit, even to tent-pins and frying-pan, was taken from home; stores were procured in New York — 600 lbs. of them; a circular letter was thoughtfully provided by His Excellency Governor Shea, which ensured a cordial welcome from the magistrate at every settlement visited. A sloop of about ten tons, the Sophia Maud, was secured, with a white conch for skipper and a black conch for pilot and cook, stores were transferred from the custom-house warehouse, the water cask was filled, and the expedition sailed.

It is not proposed to follow the haps and mishaps of this unique cruise, but simply to introduce a few of the observations which it afforded to illustrate our present topic. The first landing was made at Current, a small settlement on the northerly end of the island of Eleuthera. Here was found a people truly Arcadian in simplicity. In a population of four or five hundred not more than one-tenth were pure white and there were all shades of color, from the Caucasian to the darkest African, of a race so pure that they still cling to the native African hut with its wattled, mud-plastered walls and are as shy and coy as partridges. None but women, children and aged men were found at home, the able-bodied men being away sponge fishing, either among the Cays or at Key West, where there is more profit to be obtained. The best house in the settlement was a modern looking dwelling built of wood, new, comfortable, and with glazed windows, which were the only ones in the settlement. It belonged to a young white man who had built it at the cost of about $750, married a proper wife, and then returned to his sponge fishing. This matter of glazed windows is more important than would appear until it is understood that all houses, great or small, furnished with glazed windows are taxed five dollars per year. Owing to the extreme salubrity of the climate the windows of most houses in the settlement and those of the negroes in Nassau, are only closed at night or during violent tempests, which sometimes rage, and then with wooden shutters or blinds.

There was neither almshouse nor pauper, lock-up nor tramp, court nor criminal, but there was a clean white stone chapel and a school-house filled with bright looking children. Highways there were, ample and grass-grown, but no horses or carriages; cocoa-nut and orange trees in abundance but no commerce, manufactures, or trade. This was the counterpart of some of the old towns on our own cape where fisherman and sailor simply dwell.

Harbor Island, which has a mixed population of about two thousand, is a picturesque spot, to the east of Eleuthera, enclosing an excellent harbor between its shores, and there was more activity in the way of ship and boat building. Upon the substantial stone pier was a shipment of tomatoes ready to load for Nassau and New York. This industry of supplying tomatoes for the winter market in the north has languished of late years, partly from the uncertainty of connecting with the steamer at Nassau, but more particularly from the failure of the growers to maintain the relative excellence

NATIVE HUT, GRANTSTOWN.

A Pineapple Field.

of their product and from their persisting in sending the same qualities and varieties which they shipped twelve and fifteen years ago, all unconscious of the fact that during that time there has been a marked improvement in the quality of the varieties cultivated — so much so that the best of former times are discarded; and also of another important fact that, owing to the great progress in the winter culture of the tomato at the north, the consumer has become more exacting as to the ripeness of this vegetable and rejects those that are packed green to ripen in the crate during transportation.

The pineapple is pretty generally grown in this district, but some peculiarity in the tenure of the land, which is more or less held in common instead of in severalty, has served to discourage cultivation, men being unwilling to assume the risk and responsibility of a plantation where they do not possess the individual ownership of the soil. This would seem to be an object lesson in the social problem that is now discussed and would indicate that these people are not sufficiently trained in sociology to appreciate the advantages of communism, nor so far advanced as to look backward.

At Governor's Harbor was found a thriving settlement of perhaps fourteen hundred people with about one-tenth white. The bulk of the population is concentrated in a rocky cay, of about three hundred yards in length and one hundred yards in width, which is joined to the main island by a sandy beach, forming the harbor. Here the culture of the pineapple is conducted under the best auspices; the lands are owned by the planters and every effort is made by them to improve the quality and increase the quantity of their crop. Of the lands in these islands only on those having a red soil will the pineapple grow with the greatest success, although it may be grown of an indifferent quality on the gray soil, which is more common. This red earth owes its color primarily to the iron in its composition, and its greater fertility to the decayed algæ which were thrown up by the sea in those remote cycles when these islands were forming. This decomposed vegetable matter is rich in potash and is found in holes and pockets, crannies and caves in the rock all through the islands and under the name of cave earth, it is sought after and applied to add fertility to the soil. Thus a limit is placed upon the area of land which is most desirable for the cultivation of the pineapple and good available land is correspondingly appreciated, selling readily at from eighty to one hundred dollars per acre.

There were exported from Governor's Harbor and Tarpum Bay, two adjacent districts, in 1890, 295,345 dozens of pineapples for which was received £23,000, or $115,000. In addition to these there were consumed in a canning factory 22,000 dozen, which were returned at a value of $2,500, but which were probably more nearly worth, and doubtless realized, more than $6,000 for the pineapples, aside from the expense of packing. These were all exported to Baltimore and New York.

The red or Cuban variety is the one mostly cultivated, it being much preferred for quality and size. The plants are propagated by offsets or suckers, taken from the older plants after the fruit is cut. They are set out in August and sometimes bear the next year, but a full crop is not obtained until eighteen months after planting. The cutting season begins in May and from that time until the harvest is ended is the active season of the year with the gathering, packing and shipping of the fruit. The fields are not immediately contiguous to the settlement but are planted up and down the island, where the soil is propitious. Many of them are several miles away and the field hands go to and from their work in small cat-boats, thirty-five of which were counted in Governor's Harbor one morning. They go out with the dawn and return at sundown. The plants grow so thickly that, after the first year, but little cultivation is required and their serrated leaves form a prickly thicket that it was found impossible to penetrate, without injury to person or clothing, and yet the negro field-hands, with a better understanding of how to do it, would easily pass through it barefooted, without harm or difficulty.

The crop will vary greatly being from eight hundred to fifteen hundred dozen per acre. It has been doubled in recent years by the use of commercial fertilizers especially prepared for this crop, of which a thousand barrels were used in 1890 in the district of Governor's Harbor, costing about seven dollars and a half per barrel. Formerly it was the practice to plant a field and crop it for three or four years and then, as the soil became exhausted, let it come up to scrub and after laying fallow, as it were, for ten or twelve years clear it up and go through the routine again. Now, however, under the present use of fertilizers, the soil does not become impoverished and the plantations can be renewed for a much longer time, and so far none have been allowed to return to the wild state.

Capt. H. C. Lightbourn's Sisal Plantation.

A new and apparently a prosperous industry seems in a fair way of being created in the cultivation of Sisal hemp, which, if it proves as successful as it now bids fair to be, will afford a certain and remunerative employment for large numbers of willing hands that can now find employment for not more than half the time.

What is known as the Sisal fibre of commerce is the product of the "Henequen" plant of Yucatan, which was introduced into Florida as the *Agave Sisalana*, but is probably the *Agave Americana*. The plant which produces a similar but better quality of fibre in the Bahamas is there called the Pita plant. It is an Agave growing to the height of six feet, with stout, fleshy, pale green leaves, smooth upon the edges, with the characteristic stout thorn upon the end; it is entirely different from the Sisal or the Cuban fibre-plant, the Sanseviera.

The Pita plant is indigenous to all the islands and has hitherto been noted as a prevalent, obnoxious, and persistent weed which grew anywhere, with or without encouragement, even on the tops of old walls and, when once established, dominated and crowded out all other plants. These are exceedingly desirable qualities, as most useful plants require care and constant cultivation to preserve them from the encroachment of others that are useless or noxious.

Individuals and stock companies have entered with much enthusiasm and apparent success upon the cultivation of this plant, and there are now 4,200 acres in growing plantations stocked with 2,633,000 plants, with 1,330,000 plants in reserve in nurseries. The plantations brought more particularly to my attention were those of the Munro Fibre Co., Abaco, with 1,100 acres at Green Turtle Cay and 200 more on the Island of New Providence, planted with 750,000 plants and 300,000 more in the nurseries; and that of Mr. D. D. Sargent, at Inagua, with nearly 200 acres planted with more than 100,000 plants and as many more in nurseries, with several hundred acres in preparation for planting. Capt. H. C. Lightbourn, of Nassau, has a fine plantation of several hundred acres, having cocoa-nut trees mingled with his Pita plants. He has probably 250,000 growing plants and is successfully producing an excellent quality of fibre.

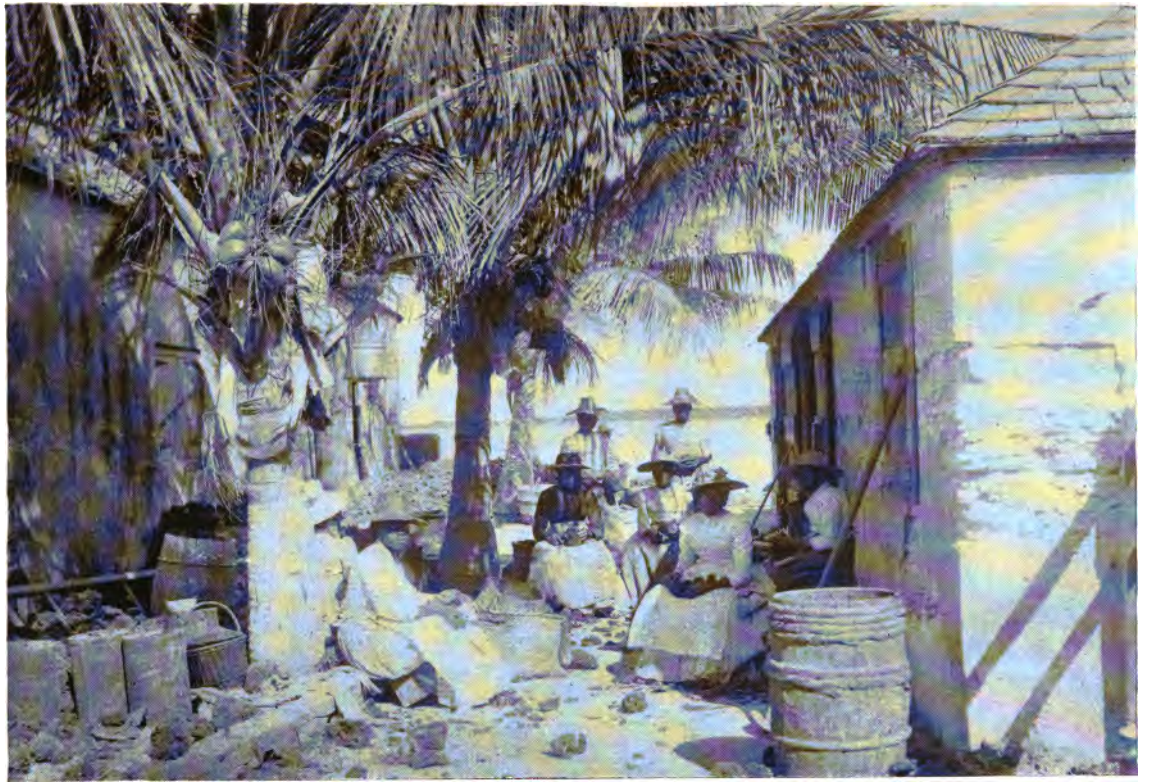
The next season's crop in the Bahamas should exceed 2,500 tons, when it will be demonstrated whether the culture is to be commercially successful.

The plants are set at from six feet by six feet, to ten feet by ten feet, according to the caprice or understanding of the cultivator. Six feet appears to be too near for the perfect development of the mature leaves, to say nothing of the requirement of sufficient space for passage between the plants, without interference or injury. About eight feet by ten feet appears to be a satisfactory compromise and will afford room for five hundred plants per acre. With the exception of weeding and reducing the lateral shoots and suckers during the first year, little care or culture is required.

Recorded experience is not yet sufficient to enable one to form a correct judgment as to the bearing life of the plant or its maximum product, but it seems to be pretty generally conceded that under ordinary circumstances the plants are in a mature and bearing condition at from four to five years of age; that about forty leaves can be cut from each plant annually, weighing about sixty pounds; that it is better for the plant, as well as the crop, to make the cutting at intervals of three or four months than to make it once a year, as the leaves thus obtained will be taken at full maturity and are not so liable to be over-ripe and comparatively worthless. When the leaves assume a position horizontal to the trunk they are sufficiently mature to cut, and if taken either before or after are of diminished value. When cut, the leaves are tied into bundles and taken to the machine, which is simple and easily operated, and are passed, one by one, through it. They are crushed and the fibre is stripped of the pulp which constitutes fully ninety-five per cent of the weight of the leaf. From eight hundred to one thousand pounds of fibre can be obtained from each acre at a cost, including cultivation, cutting, stripping, and drying, of about three cents per pound.

These plants are very tenacious of life and one has been known to grow nicely after having been kept dry in a tight box for eighteen months. When the plant arrives at its full maturity it has a tendency to run up a flower stalk called a "pole," which grows from sixteen to eighteen feet high with a diameter at the base of from five to seven inches and bears, instead of blossoms, as many as one thousand young plants, perfectly formed and ready to maintain an independent existence. This occurs probably when the plant is from ten to thirteen years old, according to the luxuriance of its growth, but, singular as it may seem, although this plant is indigenous all over these islands and the natives have

A Sisal Plantation.



SPONGE TRIMMERS.

been familiar with it all their lives, yet no one seems to know definitely what is the average life of the plant or whether that term can be prolonged by cutting out the stalk or pole, and preventing its growth.

The colonial government no longer makes large grants to companies, as it has hitherto done at reasonable prices. It is thought that enough has been done by such grants to encourage the development of the industry and demonstrate the practicability of the cultivation in a comprehensive manner. If permanently successful it will be deemed wise to sell the remaining suitable lands in small fields of ten acres, or thereabouts, to individual owners, that the people of small means, or even of no accumulations whatever, may be able to obtain their own individual holdings and produce their own crop instead of working exclusively for wages for others. This they may secure at one dollar per acre, to be paid out of the first crop raised, and it is hoped that by this method of sale a large portion of the laboring people who now obtain employment but a moiety of the time, at indifferent wages, may be induced to capitalize their lost time and thus soon become independent and self-sustaining.

The sponge fishery was an exceedingly interesting study. Probably four thousand of the islanders are engaged in gathering and curing the sponge. It is not the most attractive calling by any means. The sponges are fished from the bottom of the sea, sometimes in thirty-five and forty feet of water, either by the aid of long poles or by diving. Being secured they must be allowed to decay and then be freed from the resulting offensive animal matter, by thorough washing and drying. They are then brought to Nassau and exposed for sale at auction in a large open shed, called the Sponge Exchange, where they are sold to the highest bidder, he being a broker. No one can bid but a broker and sponges cannot be sold elsewhere than at the Sponge Exchange, so that this guild of brokers appears to have pretty much of a monopoly of the sponge business of the Bahamas. The proceeds of the sale are divided between the owners of the vessel, who are generally the outfitters, and the crew. Great complaint is made, and to an outsider it would appear to be with some reason, that between the outfitters and the brokers but little remains for the crew who perform this unpleasant and laborious toil, for they can hardly earn seventy-five dollars per year besides a very poor

fare. The outfit of provisions cannot be very extensive, for, while the Sophia Maud was lying under the lee of Pelican Cay, several sponging vessels also came into the little harbor for shelter and anchored. By the morning of the second day it was judged that provisions had run short among them, for the boats were out and they were making a lively hunt for conchs for dinner. Two men in each boat, stripped to the pelt, both ready to dive on the instant, sculled easily about, peering down into the water with a water glass made of a long box, eight inches square and twelve inches long, with a glass bottom. With this they could see the shell-fish in quite deep water and to see one was to dive for it. A civilized man is in pretty great straits for food when his appetite will enable him to feast on the flesh of the conch, *Strombus Gigas*.

The cruise of the Sophia Maud had a most auspicious termination. The interior waters among the islands form delightful cruising grounds, where one may generally look for a fair wind and make a safe anchorage every night. The last two days of the trip proved to be the only calm weather of the entire cruise; there was barely air enough to move the yacht along; the water was smooth as glass and the bottom of the ocean could be seen, at the depth of seventy feet, as clearly as if nothing intervened. The wonderful transparency of the water was difficult to understand and impossible to explain. The sun shone with great brilliancy, the atmosphere was clear and bright, and when the shadow of the great mainsail was thrown upon the surface, the water seemed to disappear as if the little vessel was by some mysterious means borne or hung suspended in the air. On the bottom could be clearly seen the different mollusks moving slowly about, the periwinkle as well as the conch; the varied and beautiful forms of coral, and the sea-plumes of all shades of color, waving gently in the current.

Fishes of all sizes and colors were swimming lazily around; the sand-fish, about the size and appearance of a good robust chub, shy and timid fellows, on being startled would bury their noses in the sand and waving their tails slowly to and fro seemed to simulate the motion of the sea-plumes about them; the barracouda, a species of shark, lying stationary thirty or forty feet away, like a clipper-built pirate as he is, waiting for his prey, seemed to ask what we were there for and what we proposed to do; the turbot with its varied colors of yellow, green, and blue, a nice fish for pan

or chowder; the blue fish, true to its name, of a bright ultramarine blue, with pink spots about its head, as it swims deep down in the water, seems to have a halo of color all about it and declines your most insinuating piscatory art. The trumpet fish, angel fish, mutton fish, parrot fish, swell fish, and a multitude of others of which there is neither time nor opportunity to learn the names, of all colors, shapes, and sizes swim lazily beneath you or sport among the mazes of marine plants with which the floor of the sea is covered. These days seemed like one continuous dream, so strange, so varied and unreal were all of our experiences both in the air and water.

As we leave these isles of summer the conclusion is inevitably forced upon us that the practical hand which is now directing their concerns will at no distant day secure for them a good and increasing measure of prosperity, which feeling seems also to impress the reflecting business men of the colony; that the native negro population possesses the same desires for accumulation that distinguish the most favored people of the world, and that when the way is shown them to utilize their industry they will eagerly pursue it; that they are as sober, orderly, and peaceable as those in other communities will average, not excepting the new New England; that the native white population are intelligent, courteous, and as enterprising as we could expect from their surroundings. They realize fully today that the flush times of blockade running during the American Civil War, were but a delirium of prodigality which has been followed by years of exhaustion and prostration. There seem to be better and more prosperous days at hand, which, let us hope will be more substantial and enduring.

Col. Wilson's lecture was illustrated by a large number of photographs, some of which, through the kindness of Mr. James H. Stark, in whose company Col. Wilson's journey was made, and who has freely given to the Society the use of the plates from his recent work on the Bahamas, are reproduced here, and also by specimens of the Sisal hemp. The lecture was received with applause, and at the close a vote of thanks to him was unanimously passed. A vote of thanks was also passed to the Committee on Publication and Discussion for the exceedingly interesting series of meetings which they had provided, of which this was the last.

The Committee on Publication have much pleasure in adding to the TRANSACTIONS the following paper, kindly offered to the Society by the author:

NOTES ON THE FUNGUS CAUSING DAMPING OFF, AND OTHER ALLIED FORMS.

By THOMAS WALTON GALLOWAY, Marshall, Mo.

I. DAMPING OFF.—The damping off fungus has been known for a number of years through its disastrous effects upon seedlings. The peculiarities of the disease and the approved methods of treating it have been described by several contributors—gardeners and botanists—in the "American Garden," June, 1890. A more extended account is to be found in "Diseases of Plants," by H. Marshall Ward. In these papers various opinions are given with regard to the probable botanical character of the plant or plants causing the malady, some of the writers regarding it not as the work of a parasite but as the direct result of certain conditions of moisture and temperature; others deeming that the disease is caused by a growth of algæ about the subterranean portion of the plant, resulting in a suspension of the functions of the roots, and a consequent destruction of the seedling.

Notwithstanding the frequency of its occurrence in greenhouses and plant beds where seedlings are grown, there is the greatest latitude among gardeners concerning the application of the term. Many apply it to any conspicuous mycelium which may grow over the sand and weaker seedlings, without any reference to the effect produced by it. Others use the term in a much more restricted sense, distinguishing by it certain manifestations of disease on the part of the seedling, rather than any external fungous growth. This is the interpretation given by the most careful gardeners with whom I have talked, and is the one which I shall adopt in my study of the disease.

The behavior of seedlings suffering from an attack of damping off presents the advantage of being very characteristic, and when once seen may always be recognized. Its first appearance is indicated by a slight paleness and drooping of the seedlings. If these be carefully removed, it will be seen that the root, either throughout its length or in portions, is beginning to shrink and

decay, and that the root-hairs are destroyed. Later, if the plant is not vigorous enough to resist the fungus and to put forth secondary roots, the disorganization of tissue extends to the stem, resulting ultimately in the toppling over of the plant and its thorough decay, although in some instances the plant remains green for several days after falling. This extends from one plant to another until only a few or none of the seedlings in a bed may be left. From the nature of the growth and method of attack of the parasite, it will be seen that it is naturally more fatal to delicate seedlings and those which get their growth slowly than to others. Such plants as Gilia, Viscaria, Lobelia, etc., are much more likely to be injured than more robust forms. The conditions which are most favorable to its growth are moist atmosphere, high temperature, with shade, or cloudy weather.

At the suggestion of Professor W. G. Farlow, upon the appearance of the disease at the Botanic Garden of Harvard College, I undertook to ascertain the exact botanical character of the cause, or causes, of damping off. I soon became convinced that the conjecture which had been offered,—that a Pythium was the real parasite,—was correct. The features above given being accepted as characteristic of the malady, many seedlings so affected were examined. The tissues of such plants, especially in the roots and in the stem just above the surface of the ground, are readily seen to be permeated by the hyphæ and reproductive bodies of a species of Pythium. The same fungus was found in considerable abundance running over the sand, and in the dead leaves of Sphagnum which covered portions of the bed. I collected some of the Pythium from the moss and sand,—because there it could be obtained more free from bacteria and hyphomycetes than in the tissues of the living plant,—and sowed it upon tender bits of plant tissue placed in Van Tiegham cells, in a hanging-drop culture. By transplanting from cell to cell, I secured Pythium as free as possible from other forms of fungi. This, while growing freely and under the most favorable artificial conditions which could be secured, was sown upon seedlings of *Gilia tricolor* which had been germinated and grown in sterilized earth, and which had shown no signs of damping off. Within five days after the addition of the Pythium, seventeen plants out of twenty-three had been attacked by it, and fourteen of these

finally succumbed, and were wholly destroyed. The three remaining ones were removed before this occurred, to furnish comparison with the more advanced cases. Similarly, seeds were germinated in a pot of sterilized soil, without being artificially infected. These, subjected as nearly as possible to the same external conditions, did not show any signs of the malady.

The fungus, according to my observation, always attacks the plant through its roots. The hyphæ penetrate into and between the cells of the root, causing a complete breaking down of the tissues. In an advanced case of the disease it is almost impossible to make out any cellular structure in the lower part of the stem and root. The dissolution of the cellulose cell wall before the advancing hyphæ is very rapid. The root-hairs and sub-epidermal growing parts are first affected, the former drooping and becoming functionless even in regions not immediately attacked. The hyphæ extend into the stem, and in some instances I have found the mycelium densely matted in the tissues of the leaves, although this does not usually take place until the plant has fallen to the ground. The vegetative hyphæ grow with very great rapidity under favorable conditions. I placed within a Van Tiegham culture cell, a plant which showed only a few filaments in its roots; in eighteen hours it was thoroughly covered and penetrated by the hyphæ without having formed a single oögonium. Twelve hours later, owing, probably, to the exhaustion of the food supply and the removal of some of the moisture, oögonia appeared in great numbers in every part of the plant. This illustrates to what an extent the fungus may spread in a single night, and how quickly it responds to changes in the conditions of food, temperature, and moisture.

The hyphæ of the Pythium are much branched, and mostly unsegmented, except in regions where reproductive bodies occur; at such points one or more septa are formed. [Fig. 1.] They vary in diameter from $4\frac{1}{2}\mu$ to 6μ* when mature, and are usually dark with densely granular protoplasm. The walls are very thin in comparison with the lumen, making the hyphæ very fragile. The reproductive bodies are of two kinds,—the oögonia and antheridia, and the non-sexual zoösporangia. The oögonia are

* The Greek letter μ denotes the unit of microscopical measurement, one-thousandth of a millimeter, or about one twenty-five thousandth of an inch. [Ed.

formed chiefly as enlargements of the terminal portion of the lateral branches. Each of these is separated by a septum from the hypha supporting it. There are usually in each case two septa, cutting off two cells from the main branch. The terminal one of these becomes spherical and forms the oögonium; the proximal cell gives off a secondary branch which results in a single antheridium. [Figs. 1 and 2, *a*.] The oögonia, however, are not confined to this terminal position. It is frequently the case that a portion of the filament, anywhere along its length, becomes separated from the remainder by two septa, and becomes an oögonium. [Fig. 3.] The oögonia are 20–26μ in diameter. Each contains one oöspore which measures 16–20μ. The oöspores have two walls, (1) the exosporium, quite thick (2–2½μ), and (2) the endosporium, presenting only a single contour. In the early stages of the formation of the oöspore, spherules of protoplasm segregate in a manner very similar to the condition seen in the formation of zoöspores. [Fig. 2.] These masses are variable in size and number, and flow together again at a later stage. In addition to the oögonia and antheridia, there are other terminal swellings which are somewhat smaller (12–15μ), each of which forms a tube in a manner entirely similar to that described by Hesse and others as the commencement of the formation of zoöspores. According to Hesse's description, the protoplasm of the sporangium passes through this tube into a thin-walled enlargement at the end, where the separation into zoöspores takes place. I regard the structures represented in Fig. 4 as being zoösporangia, although I have not succeeded as yet in procuring functional zoöspores from them. There are other enlargements of the hypha which must be considered purely vegetative. They are short portions of the filament which are cut off by two septa from the remainder, as in the case of the non-terminal oögonia; but they are not accompanied by antheridia. [Fig. 5.]

The oöspores germinate by the rupture of the thick exosporium and the protrusion of a tube from the endosporium. The extension of this tube results immediately in the normal hyphæ of the plant. [Fig. 6.]

The character and position of the zoösporangia, the monosporous oögonia, the measurements of oögonia and oöspores, and the very ramose mycelium seem to indicate that the plant is the

Pythium described by Hesse under the name *P. De Baryanum*. Saccardo gives as synonymous with it,

P. equiseti, Sadeb.

Lucidium pythioides, Lohde.

P. vexans, De By.

The destruction of the fungus may be effected very readily by subjecting the soil to conditions favorable for the germination of the oöspores before the time when it is desired for the reception of the seeds. If, in a few days, the soil be exposed thoroughly to a very dry, hot atmosphere, the very fragile vegetative hyphæ will be destroyed, and a practical sterilization of the soil will result. With proper subsequent care the likelihood of attack will be very much diminished. Several methods of treatment to be followed after the disease makes its appearance are given in the "American Garden," as cited above.

Since completing my observations on damping off, the notes of Professor Humphrey, of the Massachusetts Agricultural Experiment Station, have reached me. The two series of observation were independently made, and inasmuch as they agree lend mutual support.

BIBLIOGRAPHY.

Damping Off.—American Garden, Vol. XI, No. 6, June, 1890. H. Marshall Ward:—Diseases of Plants.

Pythium De Baryanum, etc.:—De Bary:—Pythium vexans. Botanische Zeitung, 1881. Hesse:—Pythium De Baryanum. [Inaugural Dissertation, 1874.]

II. SAPROLEGNIA MONOICA, Pringsheim.—It will perhaps not be inappropriate to include with my brief notes on Pythium the results of some observations on an allied genus, Saprolegnia.

In the Autumn of 1890 I made a collection of material from different localities in several states, with the purpose of securing species of Saprolegnia which would present the most favorable conditions for observing the nuclear action in the maturation of the reproductive bodies. Of the forms obtained, *S. monoica* seemed most suited to my use. The absence of thickenings on the wall of the oögonium, and the possibility of obtaining depauperate sporangia with only one or two oöspores make the observation of intrasporangial conditions more easy.

The nuclei of Saprolegnia are very small (1–1¼ μ), vascular, for the most part oval, and have a well marked nucleolus. They are usually so enveloped by granular protoplasm that their observation is a very difficult matter; this is especially true in the sporangia. The ordinary differential stains seem wholly inadequate to demonstrate them. The following treatment was the only one by which satisfactory results were secured. (1.) Fix with corrosive sublimate (satd. aq. sol.). (2.) Grade to 90% alcohol. (3.) Stain thirty minutes in dilute alcoholic solution of indulin (nigrosin), and rinse in 70% alcohol. (4.) Stain in Grenacher's alcoholic borax-carmine twelve hours or more. (5.) Mount in glycerine and acetic acid, or glycerine and alcohol.

This treatment very well differentiates the nuclei in the hyphæ and in the earlier stages of the oögonia. In the mycelium of the plant the protoplasm is arranged in a peripheral cylinder, from the inner surface of which extend projections into and across the central vascular region, forming a rather complicated net-work.

The nuclei are situated, for the most part, in these projections and at the crossings or enlargements of the protoplasmic strands. [Fig. 7.] In the young oögonium, one readily sees the persistence of the same general arrangement after the septum has been formed, the nuclei being clustered along the inner border of the dense protoplasmic investment. [Fig. 8.] In no case was I able to see their migration into the central vacuolar region, to the position occupied by the vacuoles with which Hartog considers them identical. This alone is not conclusive; but taken with the observations of Dangeard (Le Botaniste, April, 1890), with which my own accord in some degree, there seems to be ground for serious doubt concerning the accuracy of Hartog's interpretation. The nuclei are much smaller than the vacuoles are when they first appear, and are considerably more numerous. Dangeard further claims to have secured nuclei and vacuoles in the same preparation with sufficient clearness to preclude belief in their identity. In addition to this it must be noted that Hartog's idea, that the nuclei unite two by two to form the so-called vacuoles, which in turn unite until all the nucleine is contained in from two to four masses, which resolve and reunite to finally distribute nucleine to each of the oöspheres, is thoroughly at variance with what is known of the behavior of nuclei in general. Aside from the union of male and female pro-

nuclei, and the mingling of cell contents in conjugating forms — where sexuality is doubtful, we find nothing parallel to this commingling of nuclei, — and nowhere do we find it so thoroughly promiscuous, and succeeded by an almost equally indefinite separation and distribution of nucleine.

It is my purpose hereafter to continue more fully the study of the action of the nuclei in the formation of the oöspores.

While at work on Saprolegnia, my attention was especially drawn to what have been called resting zoösporangia. These present a moniliform series of enlargements at the free end of the hypha. [Figs. 9 and 10.] They are formed by from two to six repetitions of the process described by Rothert in his account of the formation of the simple zoösporangium. The hypha ceases to grow in length, while the protoplasmic contents continue to press toward the free end of the hypha. This results in a terminal enlargement. The protoplasm aggregates in this swelling and becomes densely granular. About the point where the hypha begins to enlarge, the dense protoplasm grades into the thinner sub-sporangial protoplasm. In this region a hyaloplasmic disc is formed by the withdrawal of the granules. From the basal portion of this disc a septum is produced, probably by material which is taken up and deposited by the "cellulin corpuscles" which Rothert states accompany the formation of the septum. In the meantime that portion of the hypha immediately below the septum begins to enlarge, passing through the same stages. This is repeated a variable number of times (from two to six), the zoösporangial swellings growing smaller proximally. Portions of the filament are not infrequently cut off without becoming enlarged at all. The protoplasm in these sporangia arranges itself as an investment of variable thickness about the periphery of the cell, with granular strands or sheets extending across the lumen, forming two or more vacuoles. This protoplasmic layer becomes finely granular and very dense, especially on its external aspect. The surface bordering the tube is much more coarsely granular, and contains nuclei. At this point the development is arrested, and the zoösporangium has the power of remaining quiescent for a considerable length of time without losing its vitality. In several instances growth was induced after more than a fortnight of rest. When stimulated to renewed activity by the addition of fresh nutriment they showed capability of developing

zoöspores [Fig. 11], or of giving off vegetative tubes which grow very rapidly. [Fig. 12.] In the former case the regular process of zoöspore formation seems to be taken up just where it was interrupted, passing through the "partial segregation" (spore-origin) stage, the "homogeneous" stage, and finally the protoplasm separating again,— this time permanently — forming zoöspores. When the tubes are formed instead, they may spring from any portion of the sporangium, usually one to each. The parietal protoplasm of the zoösporangium occupies a similar position in the germinal tube, the lumen of the latter being continuous with the cavity of the former. [Fig. 13.]

A physiological consideration of the resting zoösporangia is interesting in showing the conditions under which they are formed, and taken in connection with their structure may show their origin, use, and homology. In my cultures of *Saprolegnia monoica* I used mosquitoes as a substratum, as they were of convenient size and seemed to furnish sufficient nourishment for a complete generation of the fungus, without offering extra material to decay and attract bacteria. After getting cultures started I secured new ones by transferring escaping zoöspores only, thus being enabled to obtain, asexually, generation after generation of the plant. My observations in this particular do not accord with the statement of Hartog, that "on the whole it appears that cultures from successive generations of zoöspores tend to produce oöspores more readily." On the contrary, I found that, after ten or fifteen generations of zoösporic reproduction, there was a decided diminution in the number of oösporangia formed, as well as in the number of oöspores which they contained. In addition to this there was manifestly a tendency toward the disappearance of the antheridia even when oögonia were produced. Finally there was a total cessation in the production of oögonia, and only resting zoösporangia with two or three enlargements appeared. The disappearance of the oögonia and antheridia, and the decrease in the number of oöspores point to a deterioration of the fungus.

The formation of the resting sporangium at such a time must be interpreted as an attempt on the part of the plant to produce something of a reproductive nature longer-lived than the very transient zoöspores, after it becomes too degenerate to produce oöspores. Practically the same features were observed in experi-

menting with the supply of food. In cases where an amount of food was given which seemed inadequate to the needs of a complete generation of zoöspores and oöspores, very few of the normal zoösporangia and oögonia were formed, but the energy of the plant was directed toward the production of the resting sporangia. Thus it is evident that the insufficiency of food may directly prevent the appearance of oöspores. It is not impossible that the amount of the food supply and the prospect of immediate support — or the reverse — may at least regulate the formation of zoöspores as well.

When a new supply of nutriment is added to a culture which has developed resting sporangia, the manner of renewing growth depends somewhat upon the amount of nutriment added. If the nutriment be supplied gradually, as by the decay of another fly in close proximity, one finds that the tendency is to yield zoöspores by the normal method, whereas, if a sudden addition of food is made, as by a decoction of flies or flesh, the vegetative tubes are put forth in a manner essentially similar to the germination of an oöspore, and with a similar rejuvenescence of the resulting plant. These considerations lead me to conclude that the resting zoösporangia are intermediate in function and structure between the normal zoösporangium and the oögonium; and, taken in connection with their similarity of position, and the remarkable parallelism of the protoplasmic changes in the formation of their products, offer much reason for considering the three structures as really homologous.

In conclusion, I would express my thanks to Dr. W. G. Farlow for valuable suggestions and the use of his library.

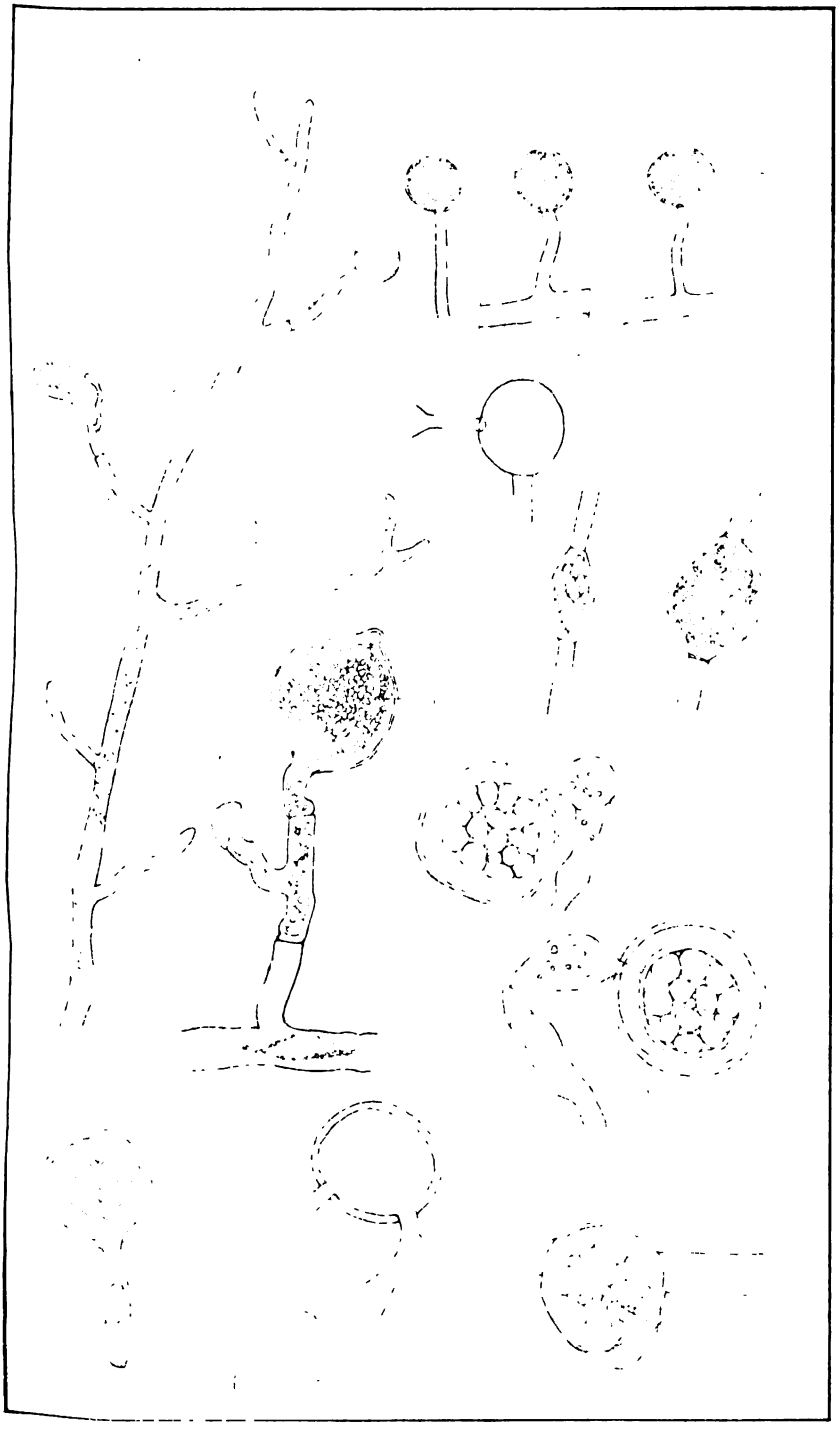
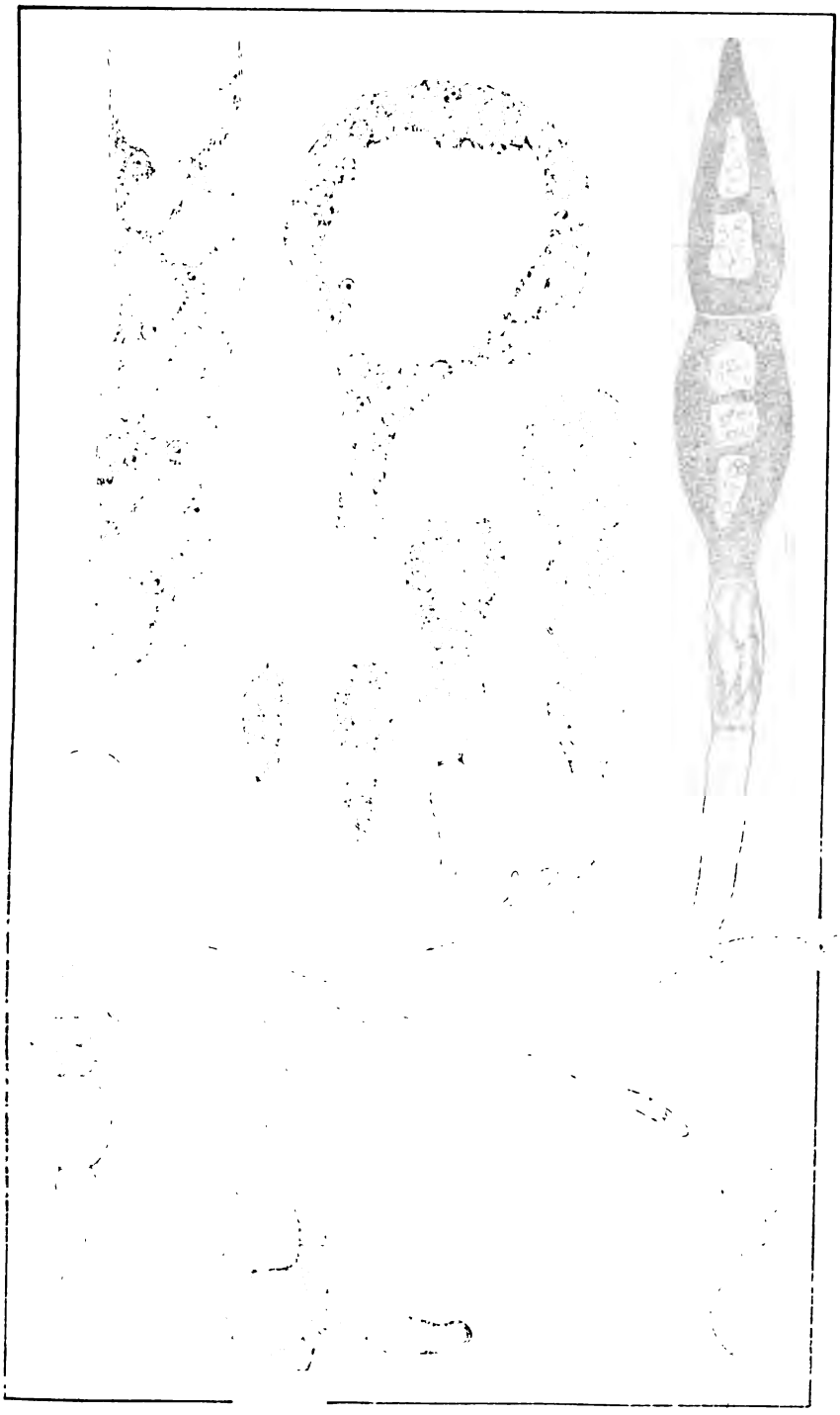
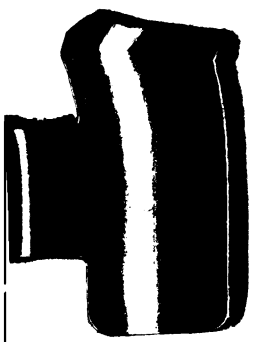
Bibliography.

Busgen:—Die Entwickelung der Phycomycetensporangien. II. Saprolegniagruppe. Pringsheim's Jahrbucher, XIII, 1882.

Dangeard:—Le Botaniste, April, 1890.

Hartog:—On Formation and Liberation of the Zoöspores in the Saprolegnieæ. Quarterly Journal Mic. Sci. Vol. 27. March, 1887.

———. Recent Researches on Saprolegnieæ (a critical abstract of Rothert's paper). Annals of Botany, Vol. 2. August, 1888.

———. Recherches sur la structure de Saprolégnées. [1889.]

Rothert:—Die Entwickelung der Sporangien bei der Saprolegnien. Cohn's Beiträge. 1890.